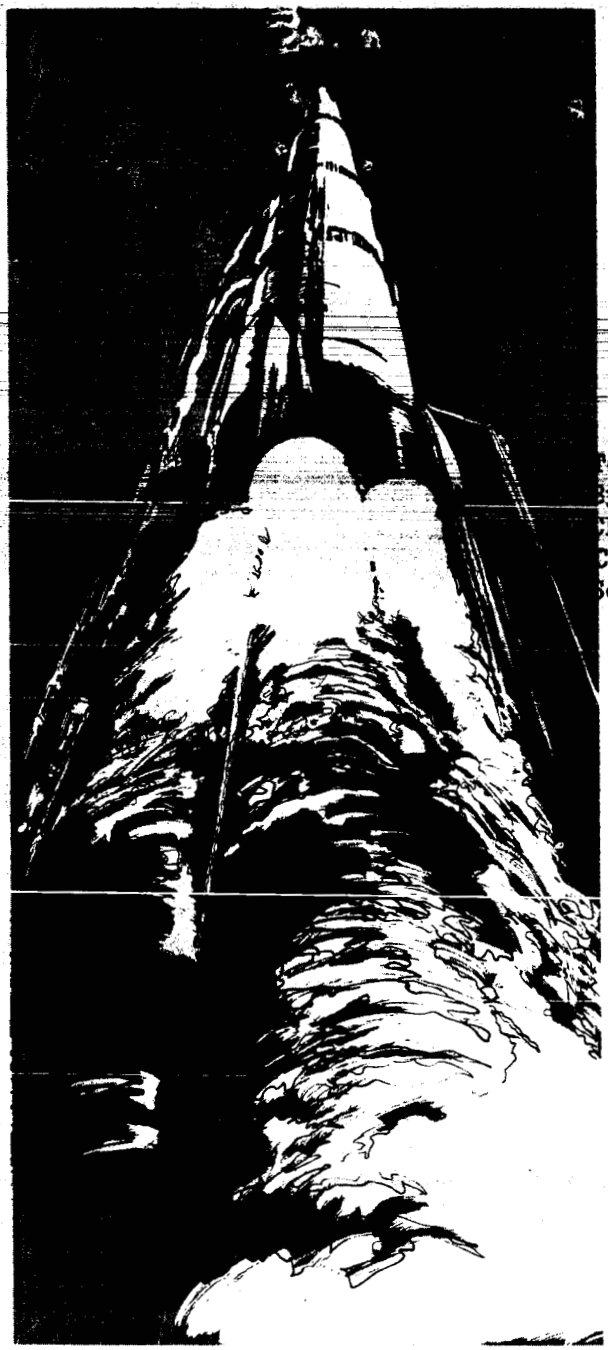

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CLASSIFICATION CHANGE

To UNCLASSIFIED

By authority of DoD Dir 5200.10

Changed by L. Shirley Date 12/5/72

Classified Document Master Control Station, NASA

Scientific and Technical Information Facility

GROUP 4
Downgraded at 3 year intervals; declassified after 12 years.

[redacted]

MAY 1, 1964

APOLLO LAUNCH VEHICLE DEVELOPMENT PROGRAM SUMMARY (U)

(NASA-TM-X-66770) APOLLO LAUNCH VEHICLE DEVELOPMENT PROGRAM SUMMARY (National Aeronautics and Space Administration) 28 p

N79-76273

FF No. 602(A)

NASA-TM-X-66770
(NASA CR OR TMX OR AD NUMBER)

(CATEGORY)

00/15 Unclas 11588

[redacted]

Introduction

A SUMMARY OF THE APOLLO LAUNCH VEHICLE DEVELOPMENT PROGRAM HAS BEEN COMPILED BY APOLLO TEST PLANNING, CODE MAT, APOLLO PROGRAM OFFICE WASHINGTON, D.C.

IT IS PRESENTED IN FOUR SECTIONS:

SECTION 1 OVERALL LAUNCH VEHICLE DEVELOPMENT PROGRAM

- A LUNAR FLIGHT TEST PROGRAM
- B TOTAL FY 1964 FUNDING

SECTION 2 SATURN I DEVELOPMENT PROGRAM

- A S-I STAGE DEVELOPMENT
- B S-IV STAGE DEVELOPMENT
- C MANPOWER & FUNDING
- D ACCOMPLISHMENTS 1963 AND 1964

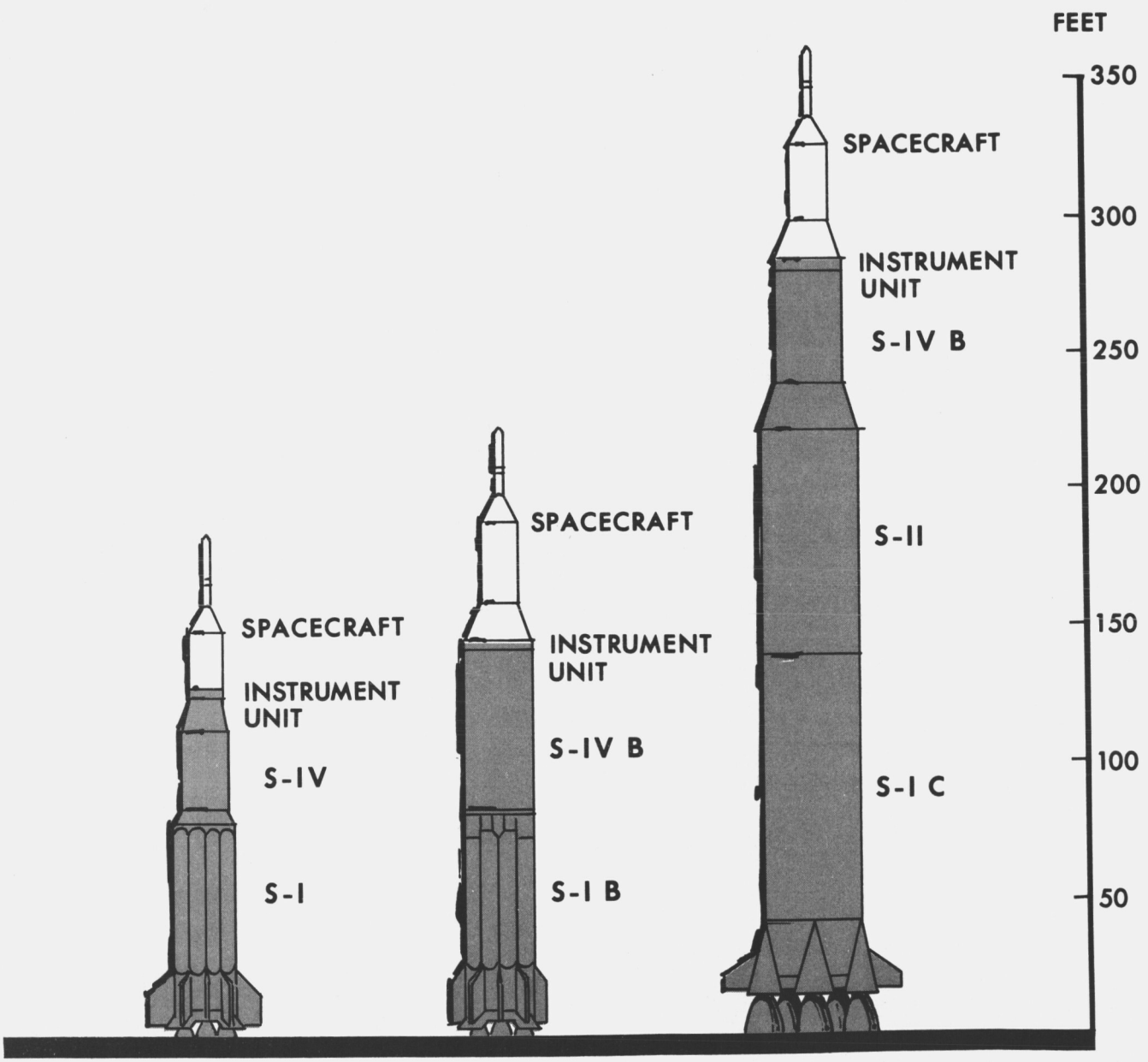
SECTION 3 SATURN IB DEVELOPMENT PROGRAM

- A S-IB STAGE DEVELOPMENT
- B S-IVB STAGE DEVELOPMENT
- C MANPOWER & FUNDING
- D ACCOMPLISHMENTS 1963 AND 1964

SECTION 4 SATURN V DEVELOPMENT PROGRAM

- A S-IC STAGE DEVELOPMENT
- B S-II STAGE DEVELOPMENT
- C S-IVB STAGE DEVELOPMENT
- D MANPOWER & FUNDING
- E ACCOMPLISHMENTS 1963 AND 1964

APOLLO LAUNCH VEHICLES

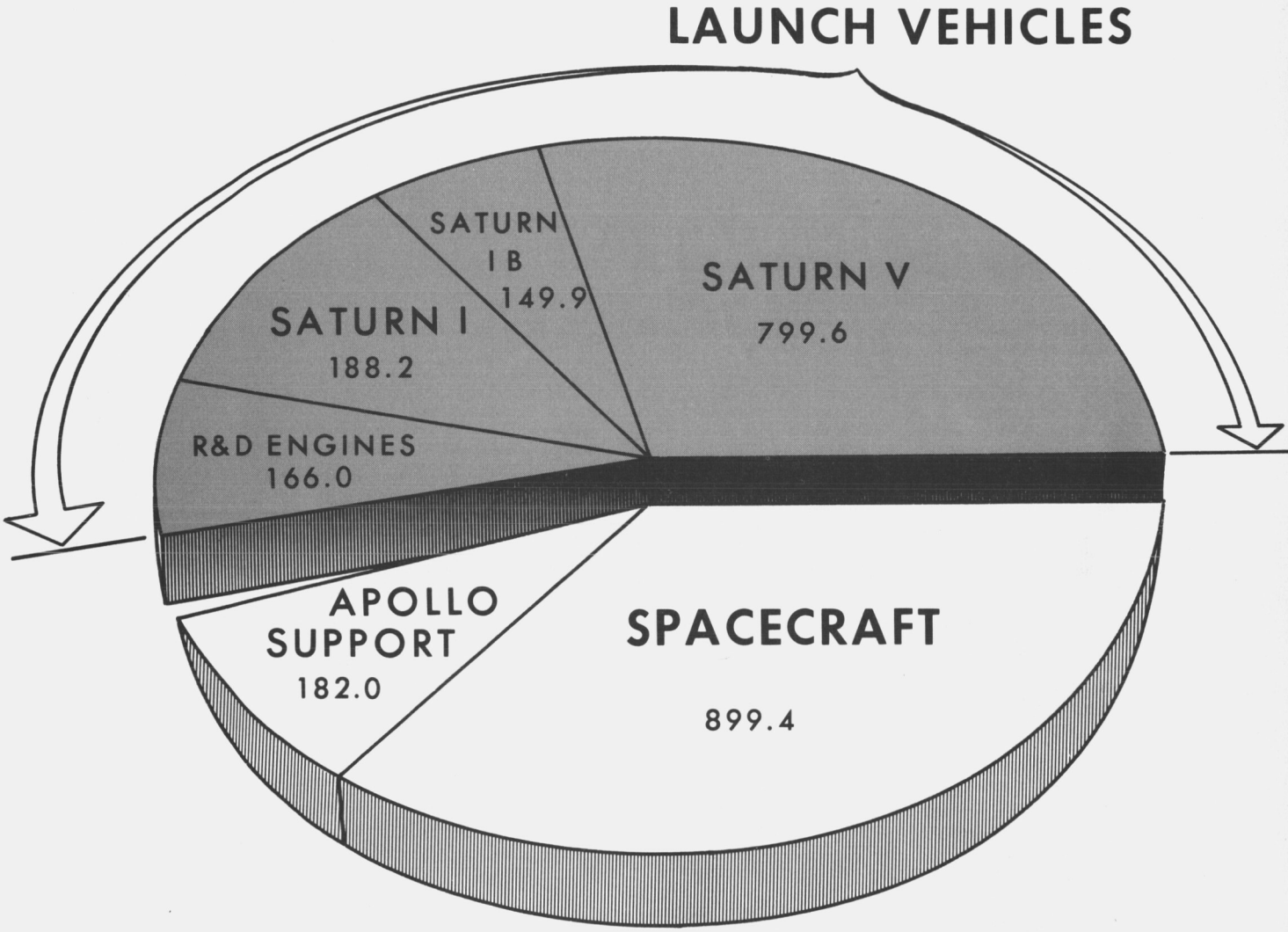


SATURN I
22,500 LBS
(100 N.M. ORBIT)

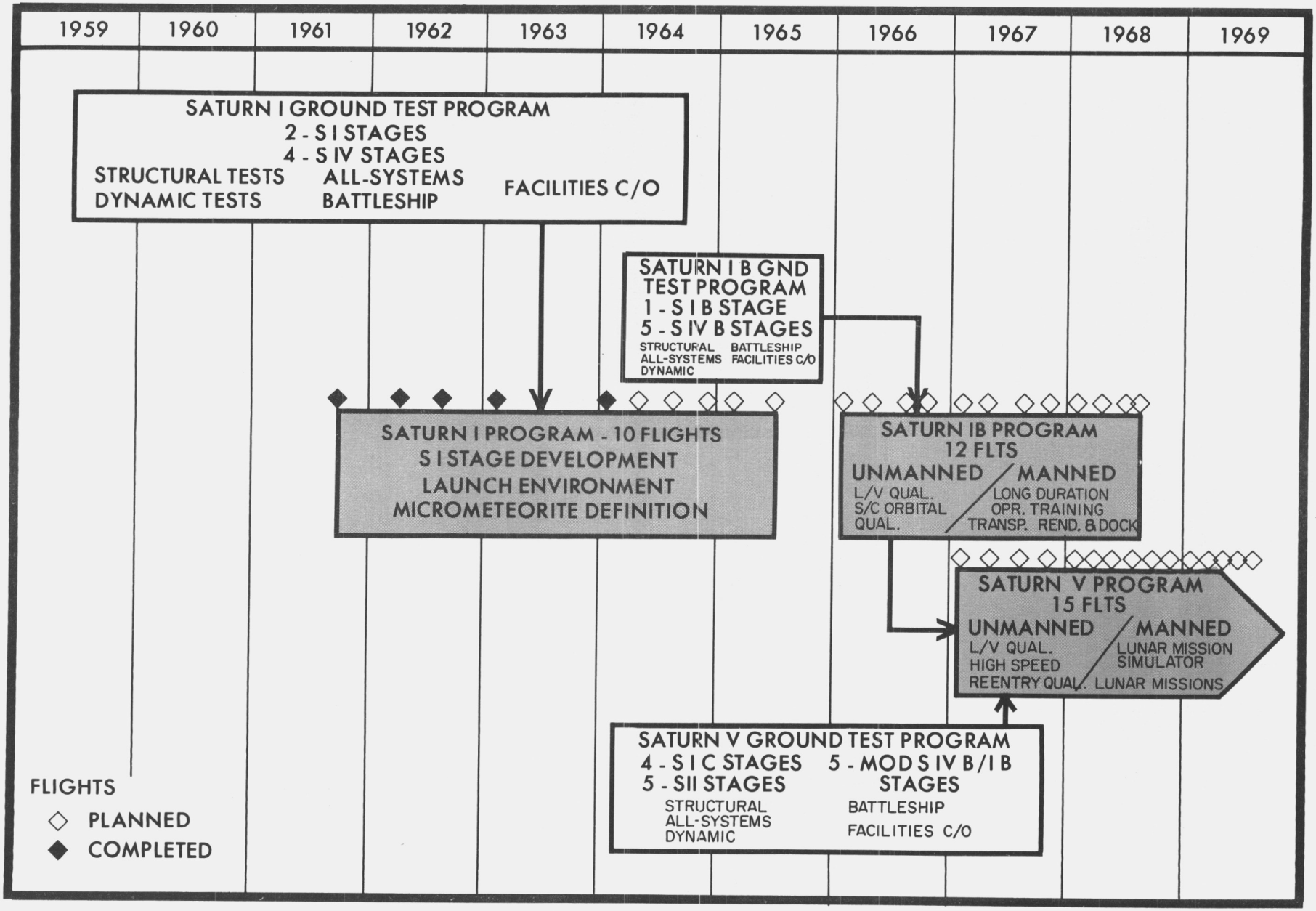
SATURN I B
32,500 LBS
(105 N.M. ORBIT)

SATURN V
90,000 LBS
(ESCAPE)

APOLLO FUNDING DISTRIBUTION FY 1964

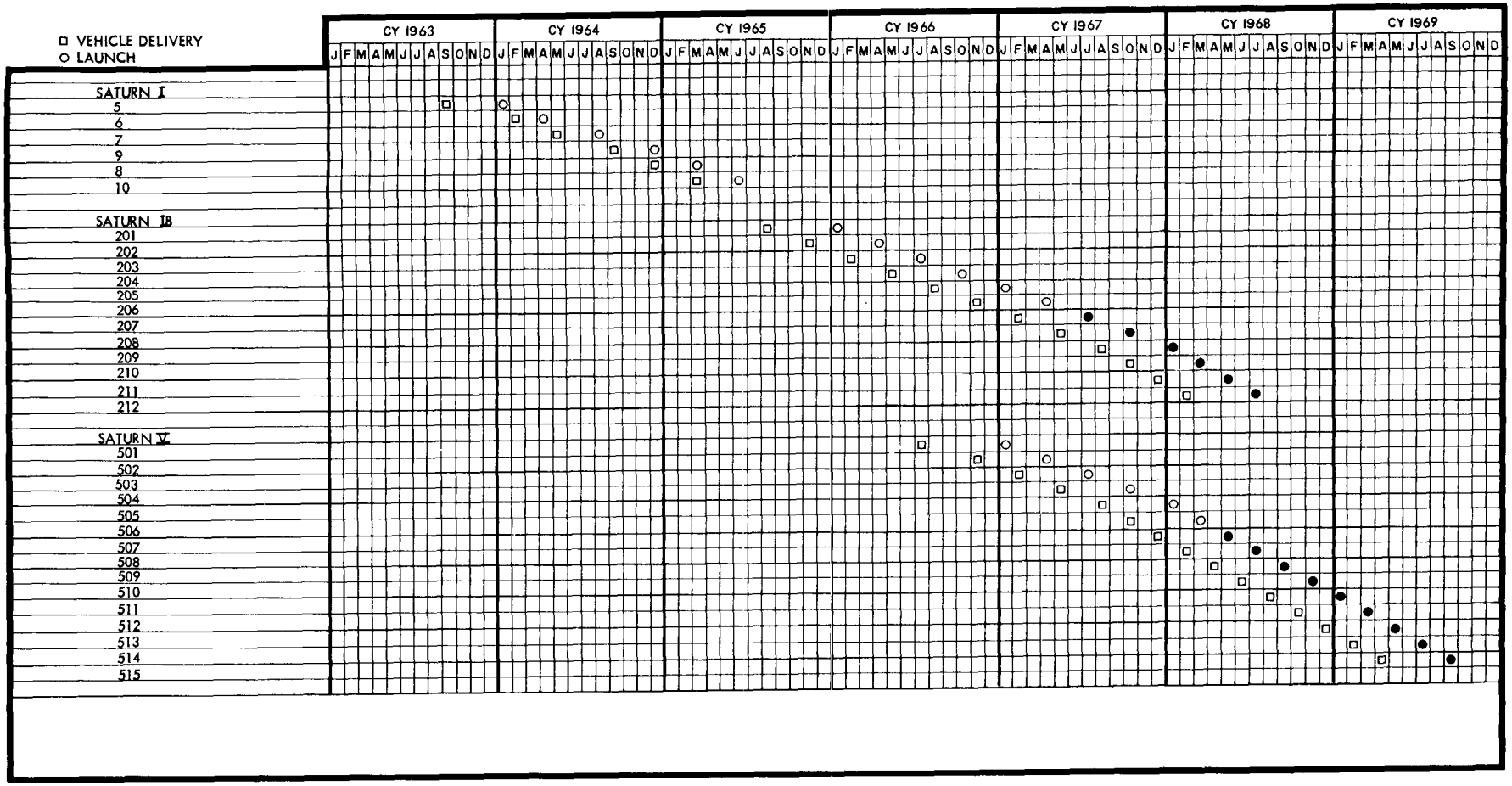


APOLLO LAUNCH VEHICLE PROGRAM PLAN



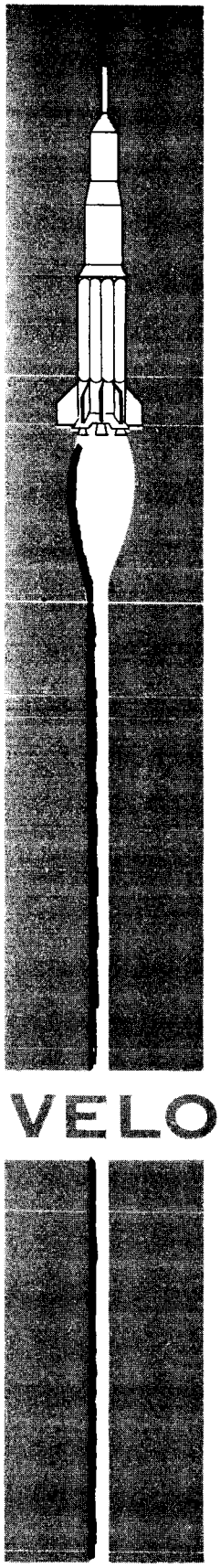
LAUNCH VEHICLE DELIVERIES

FOR APOLLO LAUNCHES



TYPES OF MAJOR GROUND TESTS

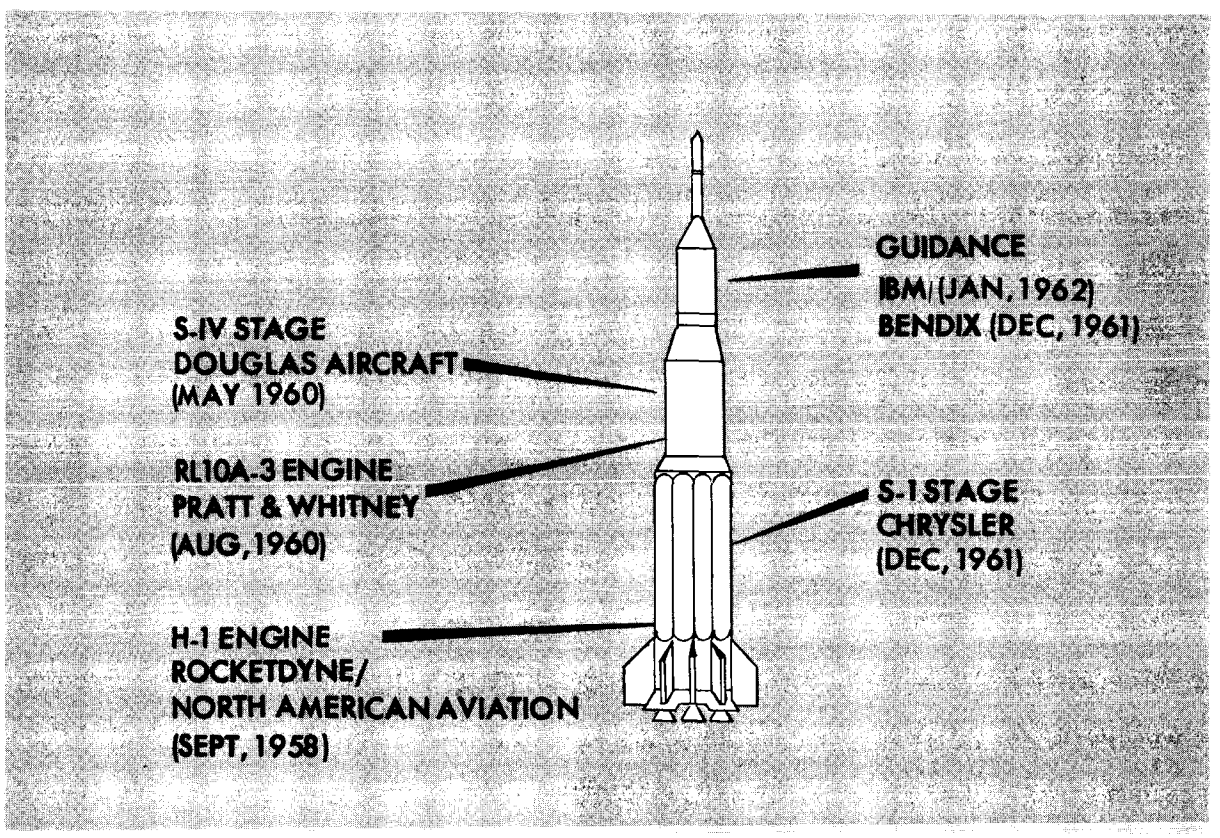
TYPES OF TEST STAGES	OBJECTIVES OF TEST
STRUCTURAL	TEST DESIGN STRUCTURAL INTEGRITY
BATTLESHIP	HEAVY WEIGHT STAGE TANK USED FOR PROPULSION SYSTEM TESTS
DYNAMIC	NON-PROPULSIVE FLIGHT CONFIGURATION STAGE USED IN DYNAMIC GROUND TESTS
ALL-SYSTEMS	FLIGHT HARDWARE AND LAUNCH TYPE GSE USED FOR QUALIFICATION OF ALL STAGE SYSTEMS
FACILITY CHECKOUT	NON-PROPULSIVE-FLIGHT STAGE TO CHECK STATIC TEST AND LAUNCH FACILITIES



SATURN I

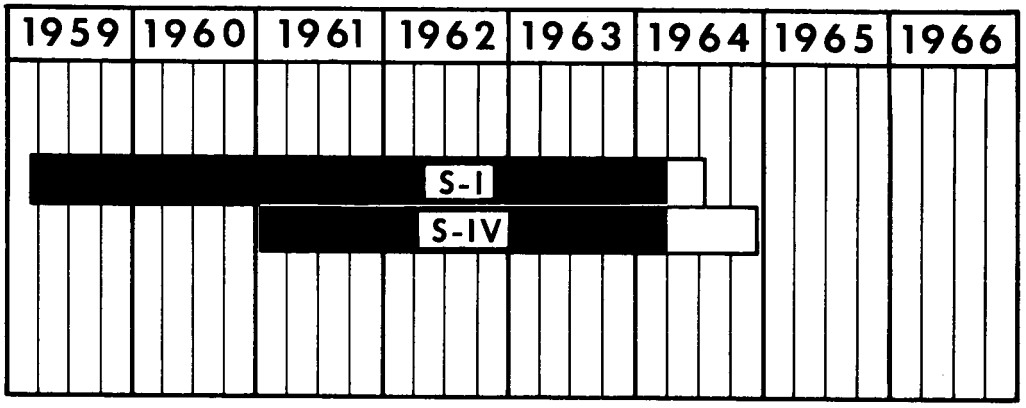
DEVELOPMENT PROGRAM

SATURN I
VEHICLE DEVELOPMENT TEAM



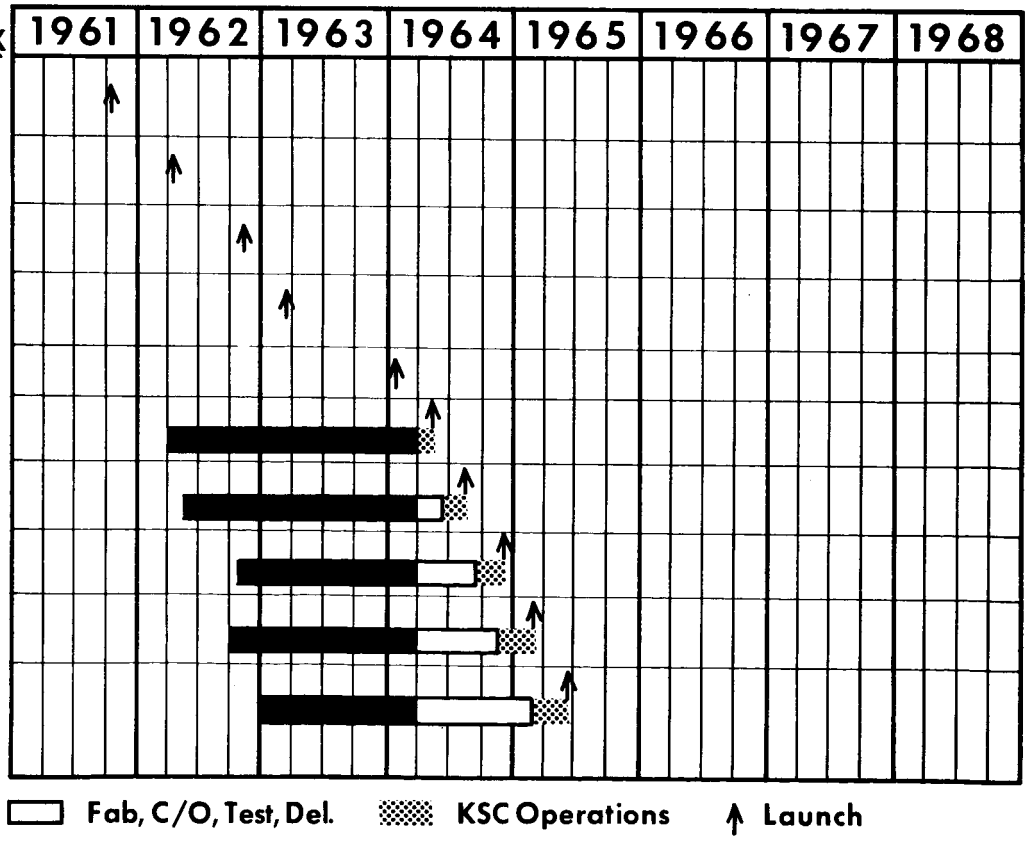
SATURN I PROGRAM PLAN

GROUND DEVELOPMENT TEST



FLIGHT TEST

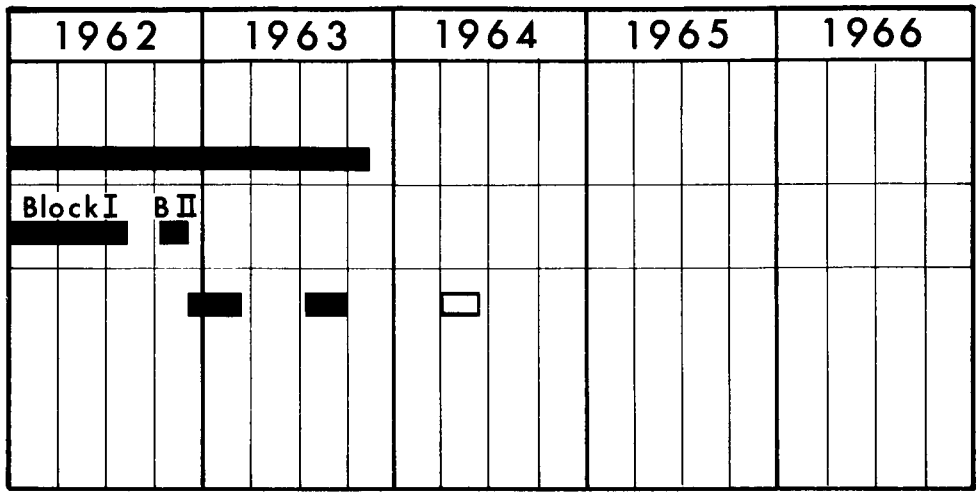
FLIGHT	LAUNCH COMPLEX
SA-1	34
SA-2	34
SA-3	34
SA-4	34
SA-5	37B
SA-6	37B
SA-7	37B
SA-9	37B
SA-8	37B
SA-10	37B



S-I STAGE

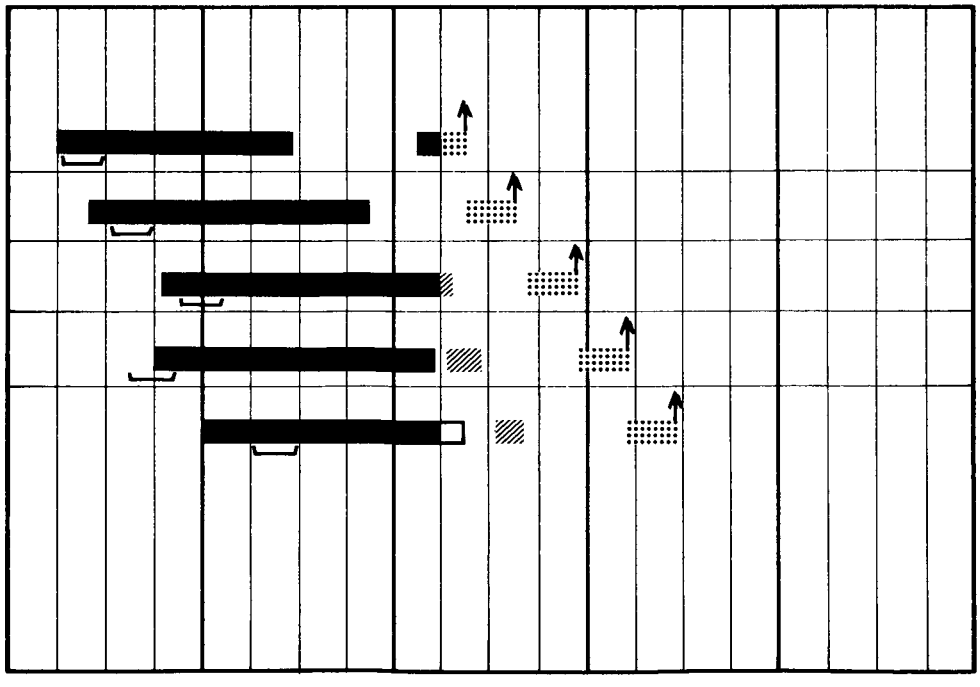
GROUND TEST PROGRAM

TYPE OF TEST	LOCATION
STRUCTURAL	MSFC
ALL SYSTEMS	MSFC
DYNAMIC	MSFC



FABRICATION & C/O FOR FLIGHT TESTS

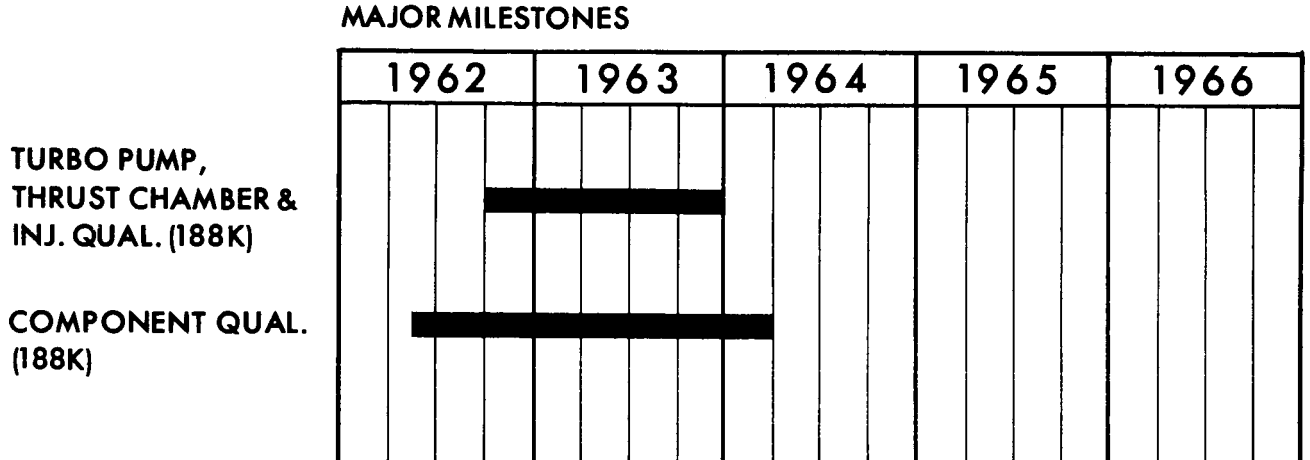
STAGE	FLIGHT
S-I-6	SA-6
S-I-7	SA-7
S-I-9	SA-9
S-I-8	SA-8
S-I-10	SA-10



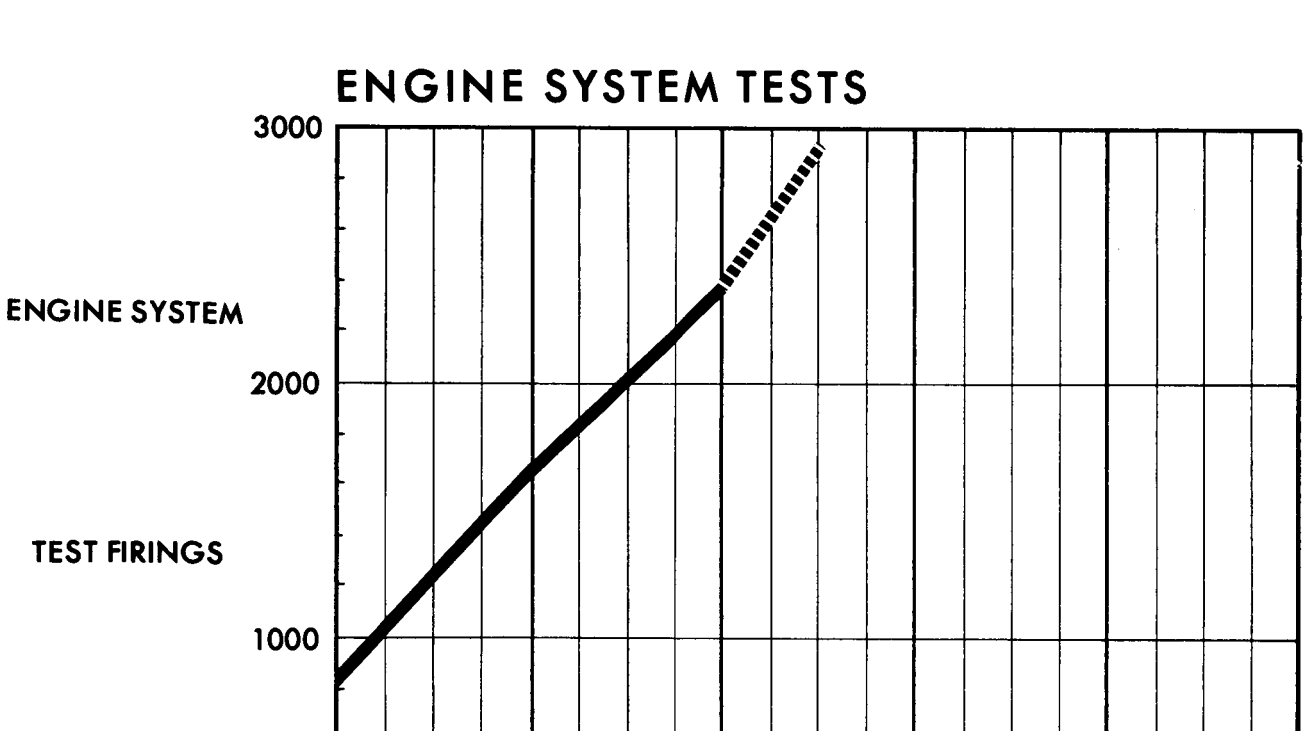
Fab, Assembly, C/O Static Test KSC Operations
Engine Delivery Launch

H-1 ENGINE DEVELOPMENT PLAN

MAJOR MILESTONES



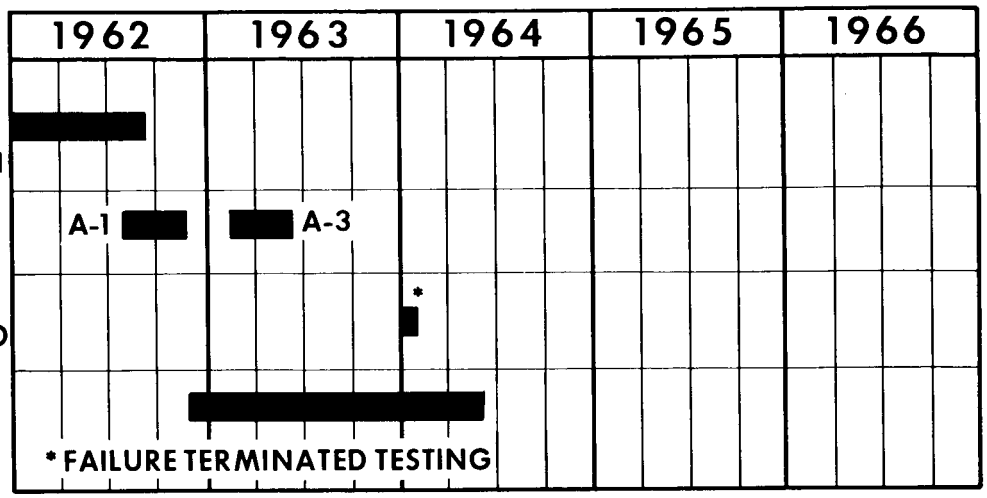
ENGINE SYSTEM TESTS



SATURN I
S-I STAGE

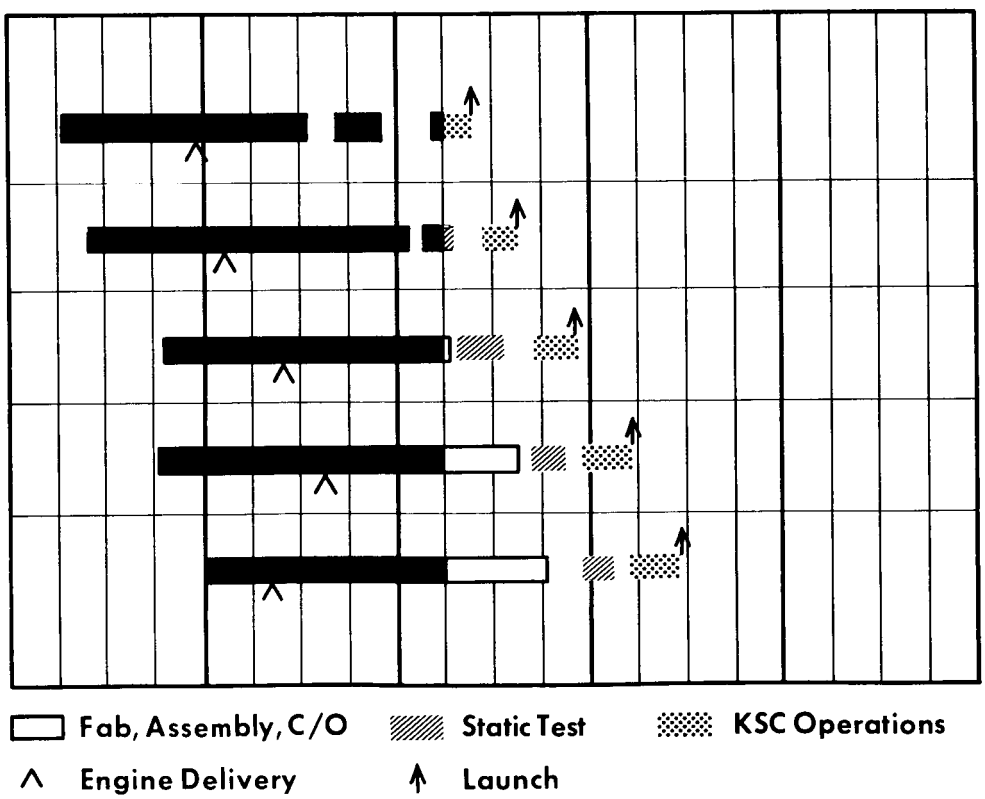
GROUND TEST PROGRAM

TYPE OF TEST	LOCATION
STRUCTURAL	SANTA MONICA HUNT. BEACH
BATTLESHIP	SACRAMENTO
ALL SYSTEMS	SACRAMENTO
DYNAMIC	MSFC



FABRICATION & C/O FOR FLIGHT TESTS

STAGE	FLIGHT
S-IV-6	SA-6
S-IV-7	SA-7
S-IV-9	SA-9
S-IV-8	SA-8
S-IV-10	SA-10



RL-10 ENGINE DEVELOPMENT

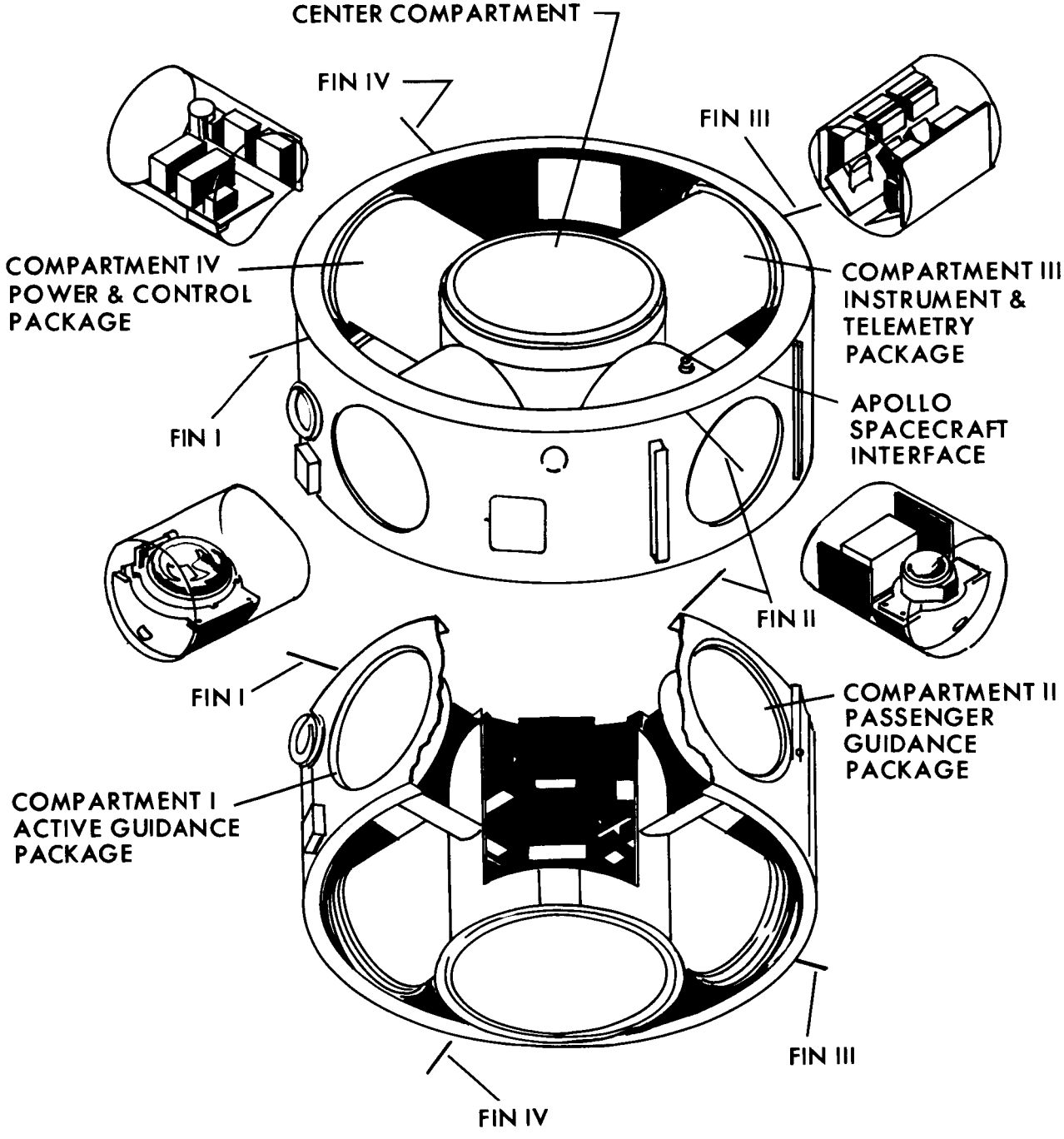
MILESTONES

MILESTONE	
DEL. 1st GTE (A-1)	JULY 1960
DEL. 1st GTE (A-3)	JULY 1962
PFRT (A-1)	OCT 1961
PFRT (A-3)	JUNE 1962
QUAL.	SCHEDULED-SEPT 1964

TECHNICAL HISTORY (DEC 1, 1963)

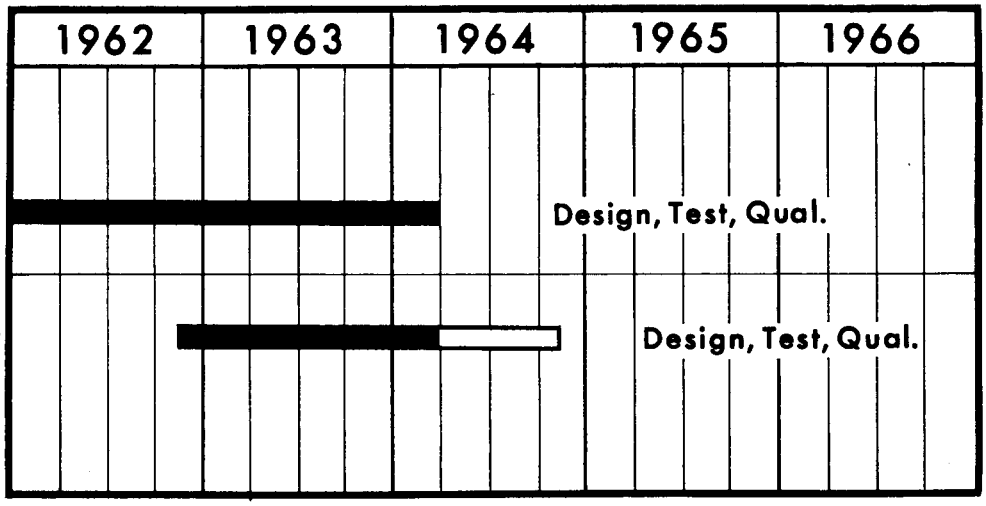
TOTAL FIRINGS	4,907
TOTAL FIRING TIME	634,242 SECONDS

PRESSURIZED INSTRUMENT UNIT



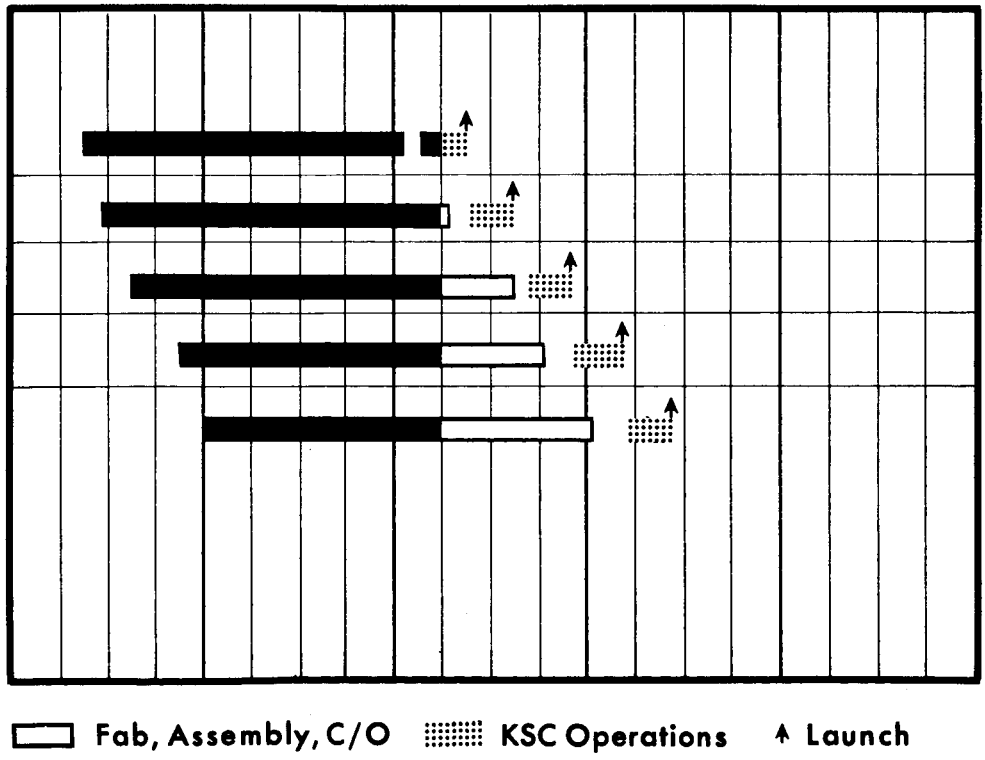
DEVELOPMENT PLAN

UNIT	FLIGHT
PRESSURIZED	5-7
NON PRESSURIZED	9,8 & SUBS



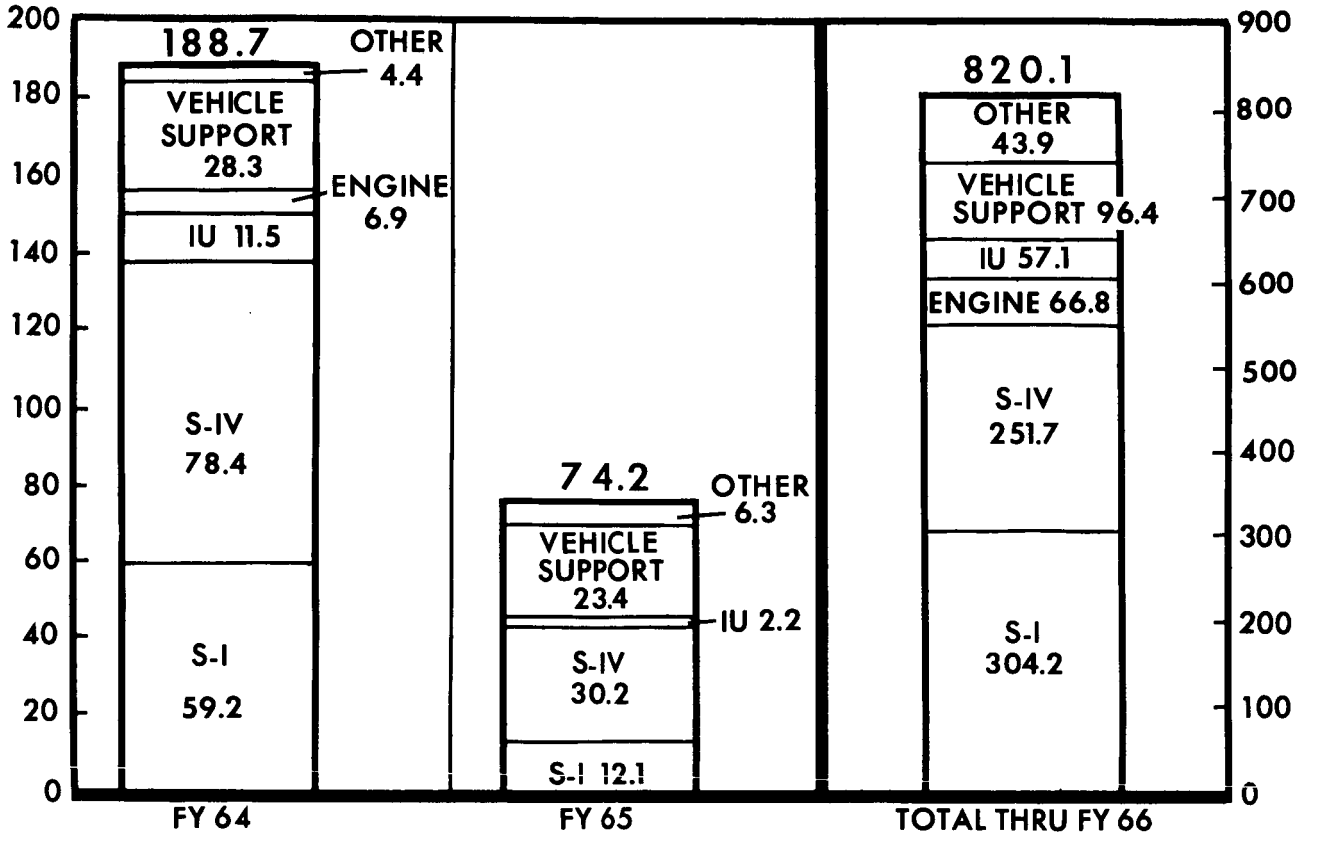
FABRICATION & C/O FOR FLIGHT TESTS

UNIT	FLIGHT
IU-6	SA-6
IU-7	SA-7
IU-9	SA-9
IU-8	SA-8
IU-10	SA-10

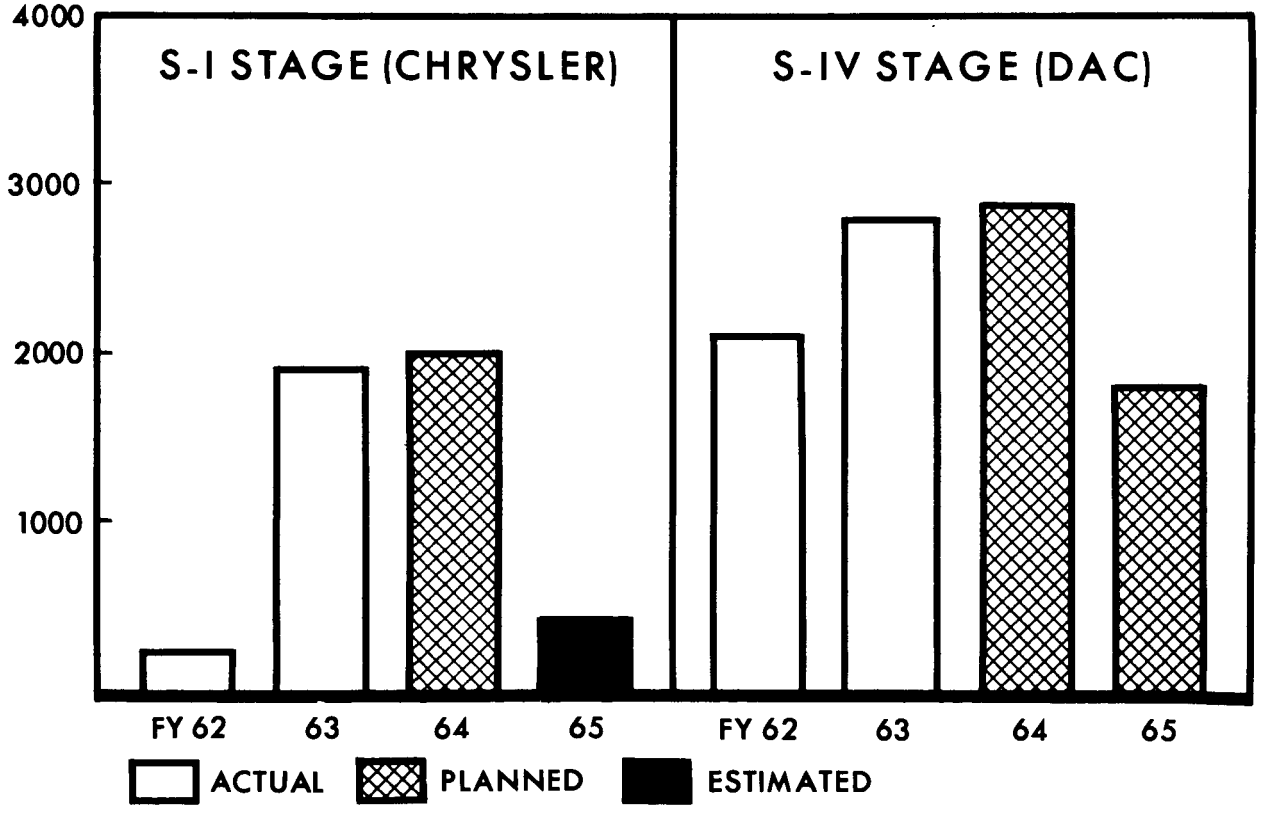


FUNDING AND MANPOWER

FUNDING (MILLIONS)



CONTRACTOR MANPOWER (EQUIVALENT DIRECT)



COMPLETION OF BLOCK I SATURN VEHICLE FLIGHT TESTS

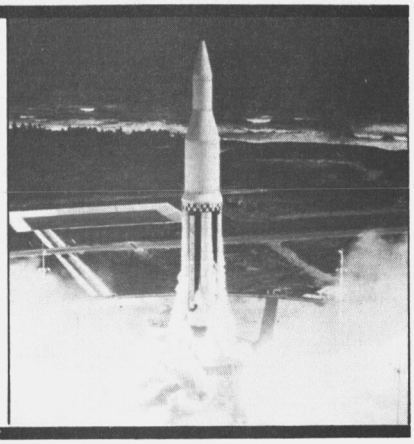
SA-1

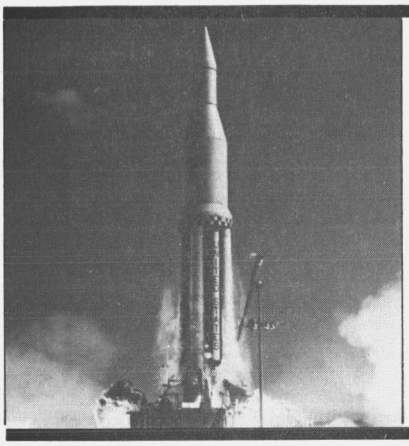
LAUNCH DATE OCTOBER 27, 1961

PERFORMANCE OF PROPULSION SYSTEM, VERY SATISFACTORY

PROPELLANT SLOSHING FULLY EVALUATED

NO SERIOUS DESIGN DEFICIENCIES





SA-2

LAUNCH DATE APRIL 25, 1962

LAUNCH AND FLIGHT TEST SUCCESSFUL

PROJECT HIGHWATER, 22,900 GALS. OF H2O RELEASED INTO IONOSPHERE

SA-3

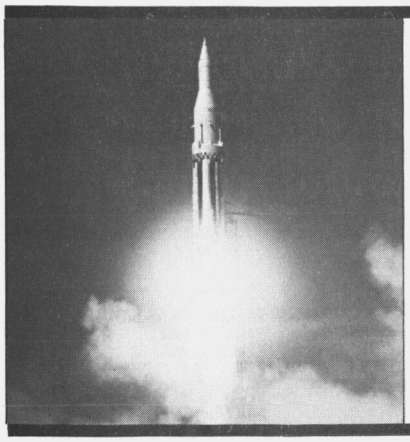
LAUNCH DATE NOVEMBER 16, 1962

FLIGHT TEST A COMPLETE SUCCESS

FULL PROPELLANT LOADING

PROJECT HIGHWATER, 2ND PHASE

PROTOTYPE HORIZON SENSOR EVALUATED



SA-4

LAUNCH DATE MARCH 28, 1963

SUCCESSFUL FLIGHT TEST

ENGINE OUT CAPABILITY DEMONSTRATED

BLOCK II AERODYNAMIC PROTUBERANCES EVALUATED

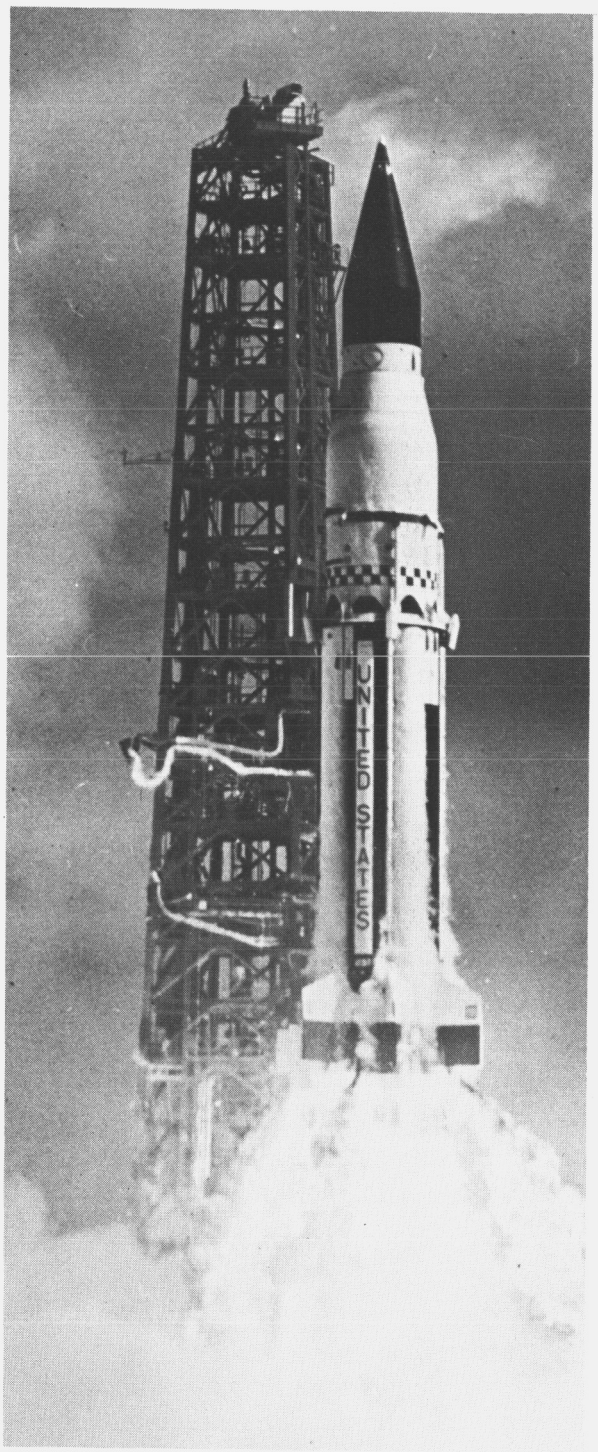
SATISFACTORY OPERATION OF MISTRAM MISSILE TRAJECTORY MEASUREMENT SYSTEM

FLIGHT ACCOMPLISHMENTS

COMPLETION OF FIRST BLOCK II DEVELOPMENT FLIGHT SA-5

PRIMARY OBJECTIVES

- L/V PROPULSION STRUCTURAL AND CONTROL DEMONSTRATION
- FIRST LIVE TEST OF S-IV STAGE
- FIRST FLIGHT TEST OF INSTRUMENT UNIT
- S-1/S-IV SEPARATION DEMONSTRATION (SINGLE PLANE)



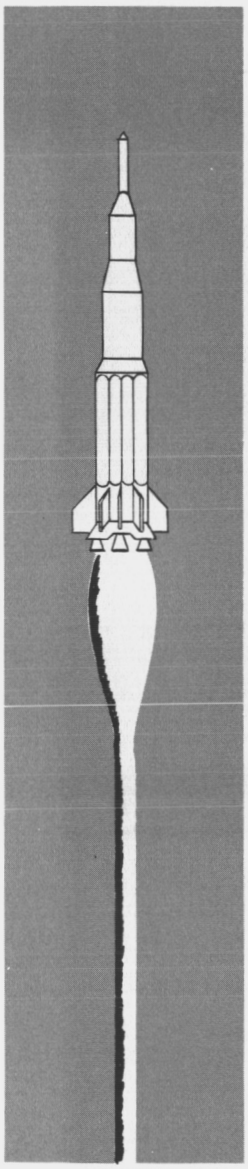
ACCOMPLISHMENTS

1963

- COMPLETION OF S-IV BATTLESHIP TESTS
- COMPLETION OF FIRST CONTRACTOR PRODUCED S-I STAGE
- CONDUCTED A TOTAL OF 3350 H-1 ENGINE FIRINGS FOR 225,000 SECONDS DURATION
- DELIVERED 45 H-1 ENGINES FOR R&D AND MANNED FLIGHTS
- COMPLETED A TOTAL OF 3800 RL-10 ENGINE FIRINGS FOR 535,000 SECONDS DURATION

1964

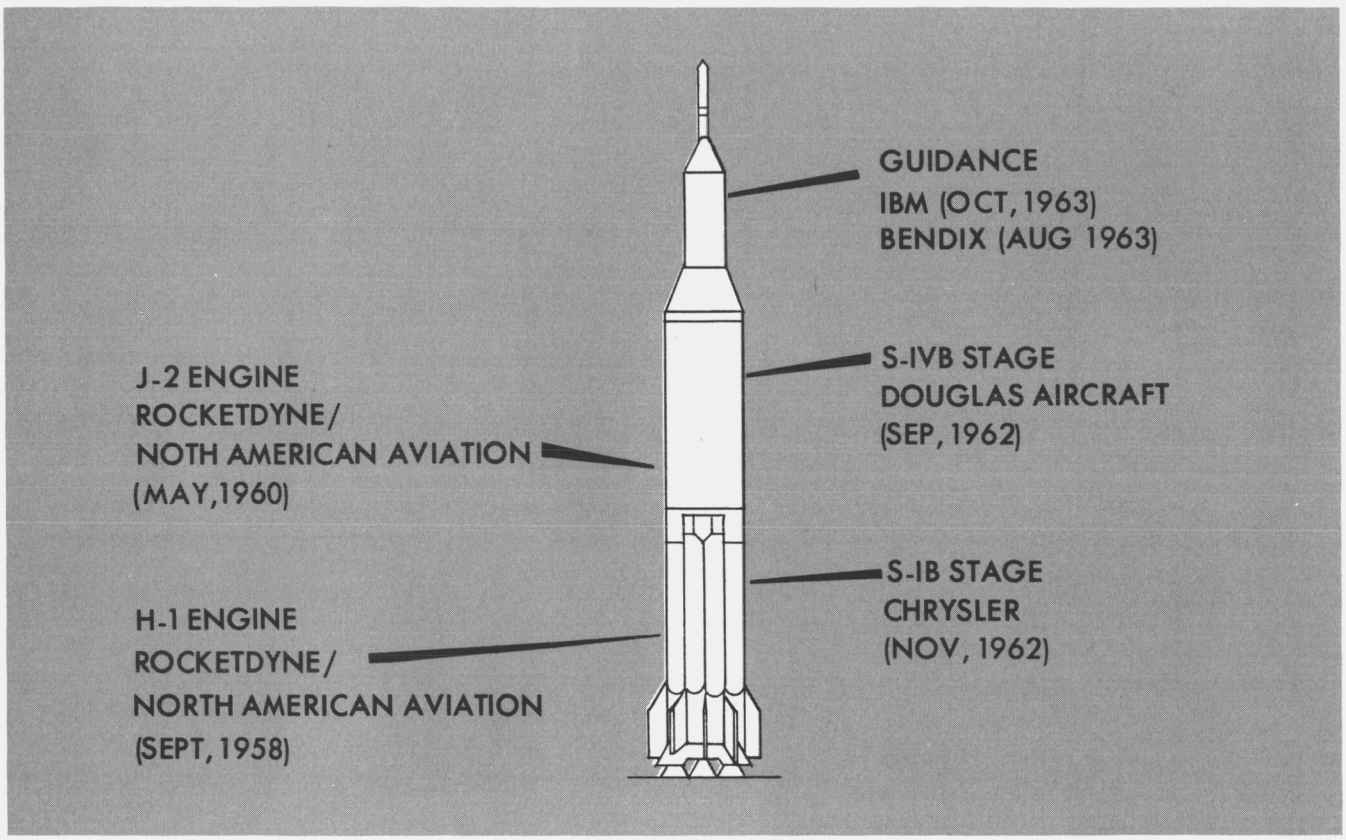
- COMPLETE 3 ADDITIONAL SATURN I FLIGHTS
  - A TWO S/C LAUNCH ENVIRONMENT FLIGHTS
  - B ONE EARTH ORBITAL MICROMETEORITE EXPERIMENT
- COMPLETION OF ALL GROUND TESTS
- COMPLETE FABRICATION OF ALL FLIGHT HARDWARE



SATURN IB

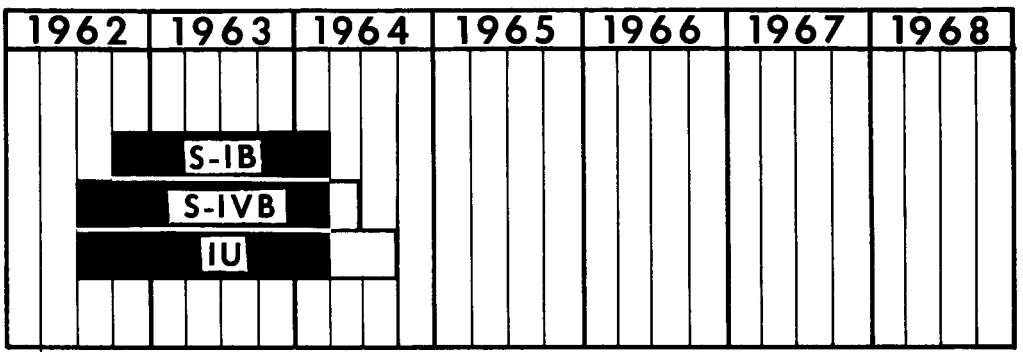
DEVELOPMENT PROGRAM

SATURN IB
VEHICLE DEVELOPMENT TEAM

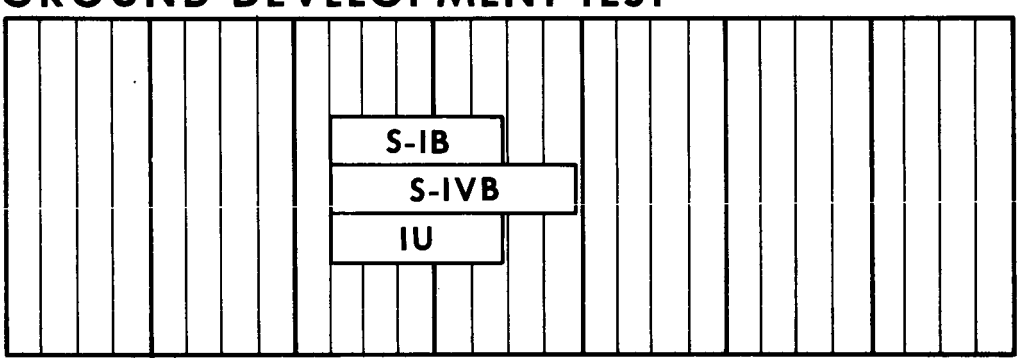


SATURN IB PROGRAM PLAN

DESIGN & ENGINEERING

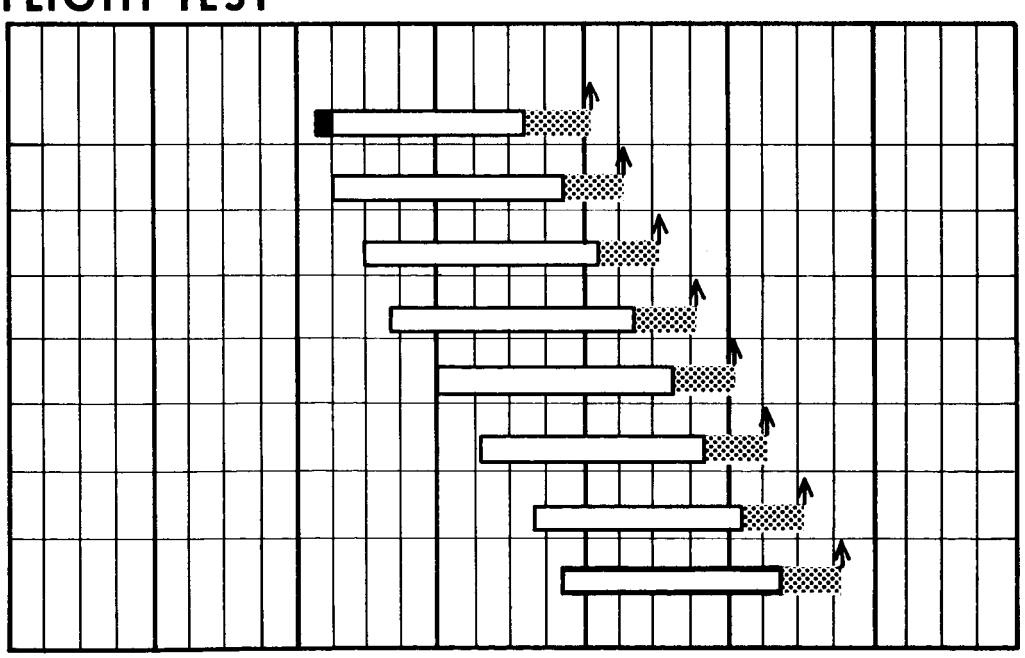


GROUND DEVELOPMENT TEST



FLIGHT TEST

FLIGHT	LAUNCH COMPLEX
201	34
202	34
203	37B
204	34
205	37B
206	34
207	37B
208	34



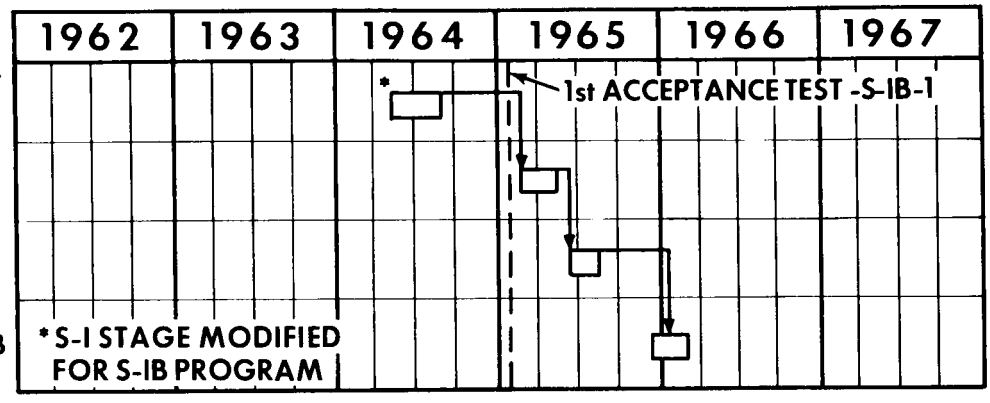
Fab, Assembly, C/O Del. KSC Operations Launch

[redacted]

S-IB STAGE

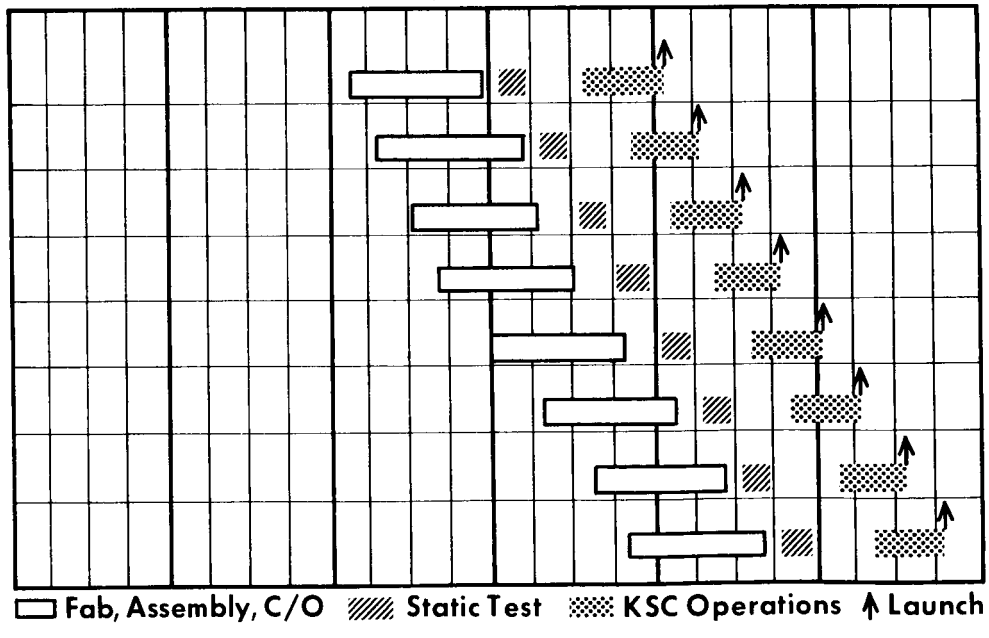
GROUND TEST PROGRAM

TYPE OF TEST	LOCATION
STRUCTURAL	MSFC
DYNAMIC	MSFC
FACILITIES C/O	AMR-VLF 34
	VLF 37B



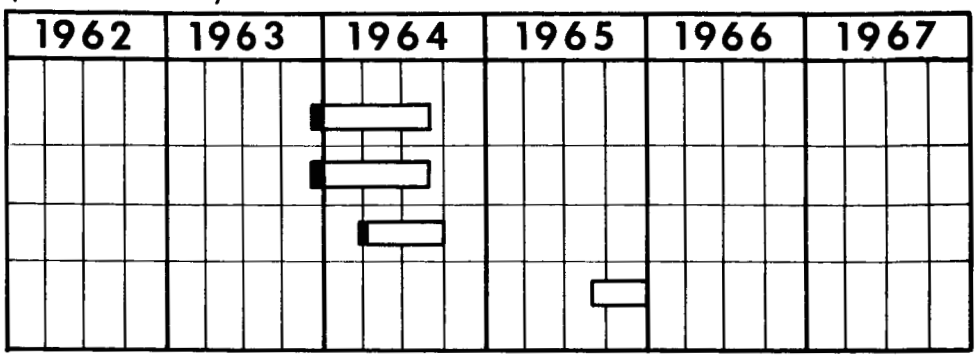
FABRICATION & C/O FOR FLIGHT TESTS

STAGE	FLIGHT
S-IB-1	201
S-IB-2	202
S-IB-3	203
S-IB-4	204
S-IB-5	205
S-IB-6	206
S-IB-7	207
S-IB-8	208

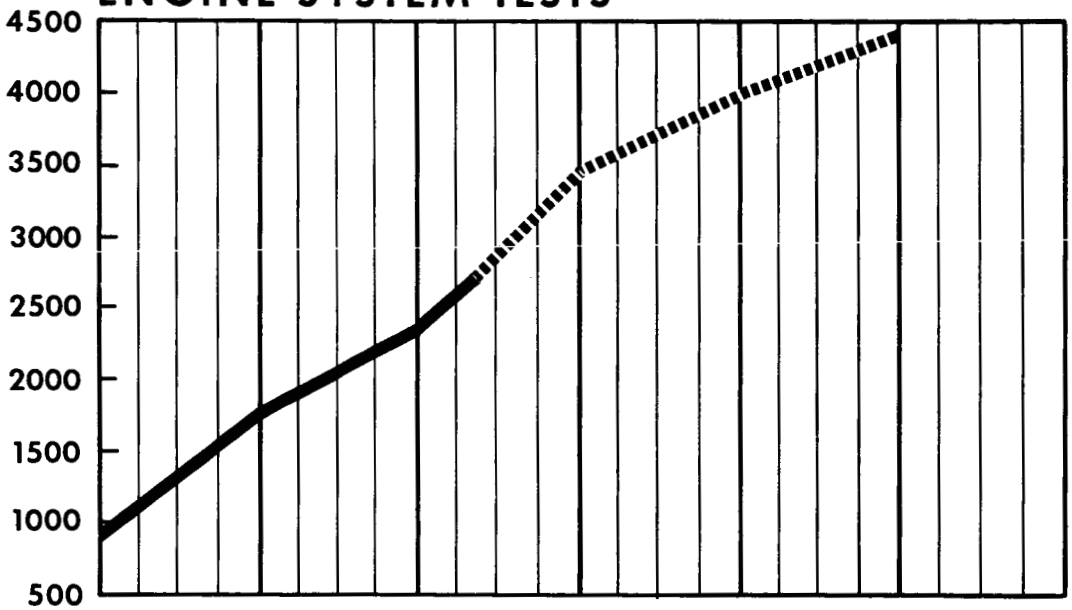


H-1 ENGINE DEVELOPMENT PLAN

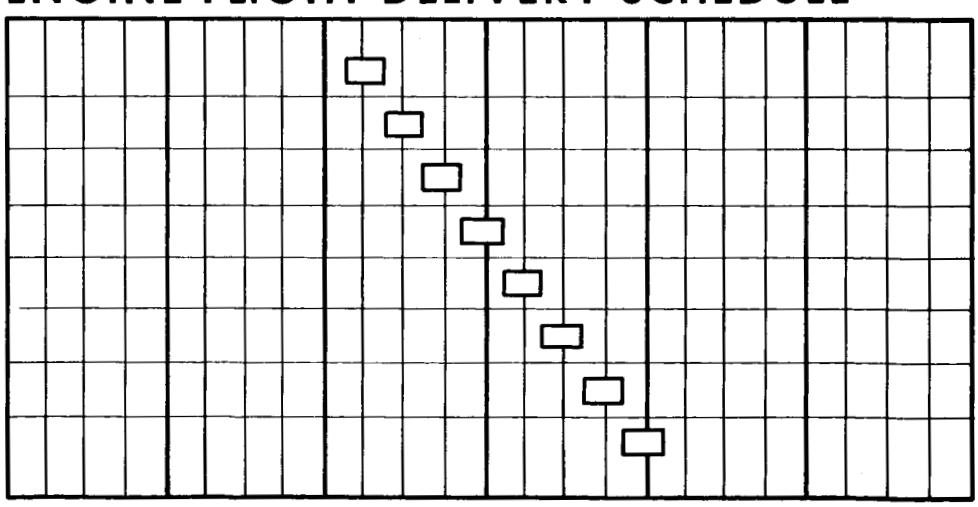
(200 K THRUST)



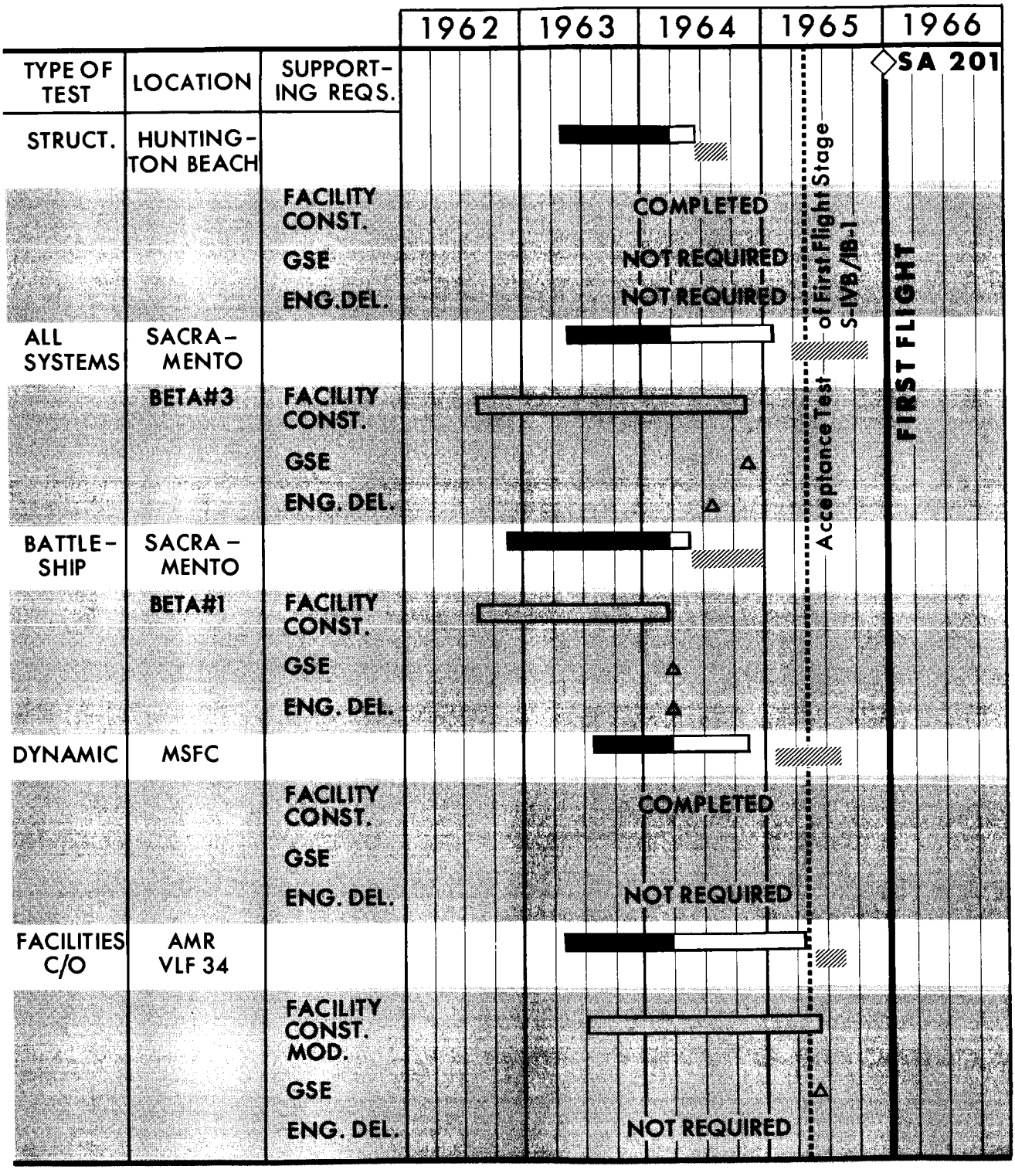
ENGINE SYSTEM TESTS



ENGINE FLIGHT DELIVERY SCHEDULE



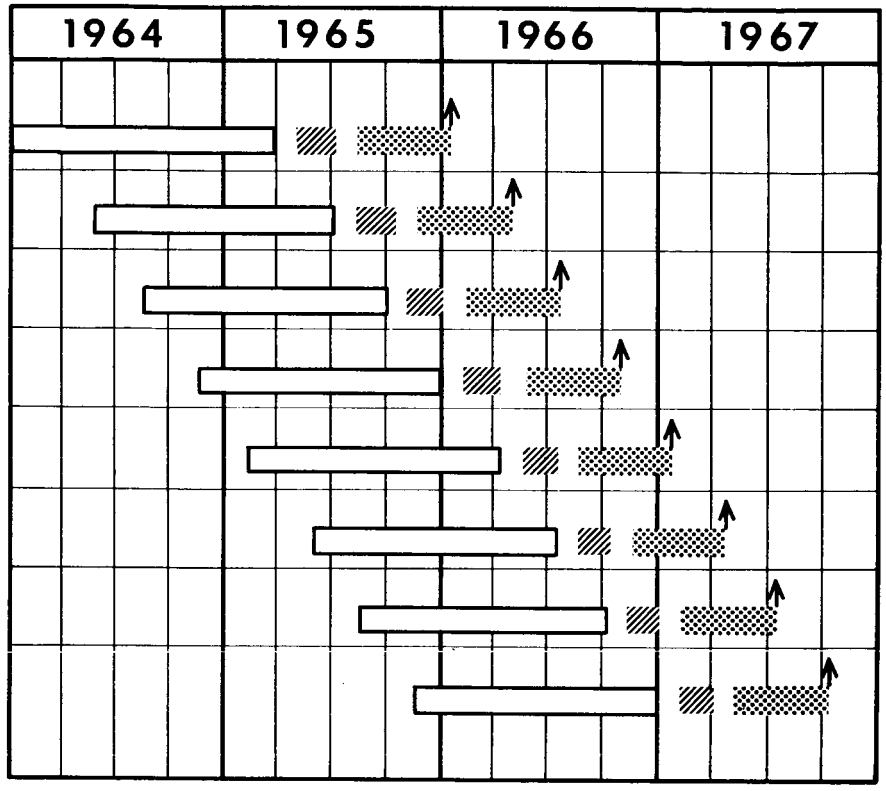
GROUND TEST PROGRAM



[redacted]

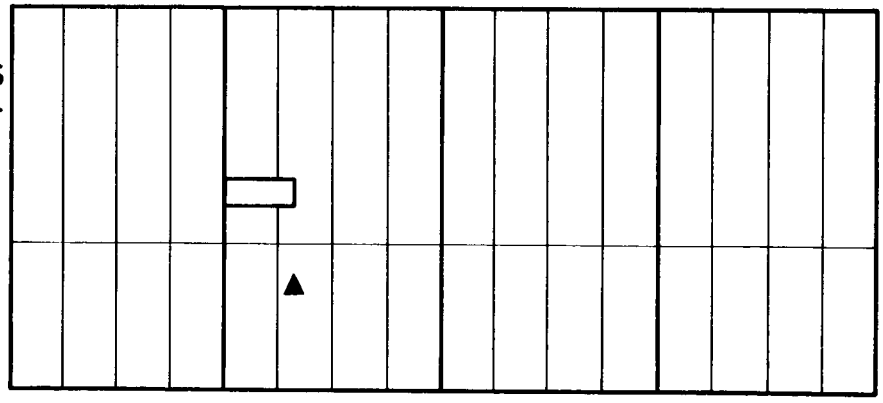
FABRICATION & DELIVERY FOR FLIGHT TEST

STAGE	FLIGHT
S-IVB/IB-1	201
S-IVB/IB-2	202
S-IVB/IB-3	203
S-IVB/IB-4	204
S-IVB/IB-5	205
S-IVB/IB-6	206
S-IVB/IB-7	207
S-IVB/IB-8	208



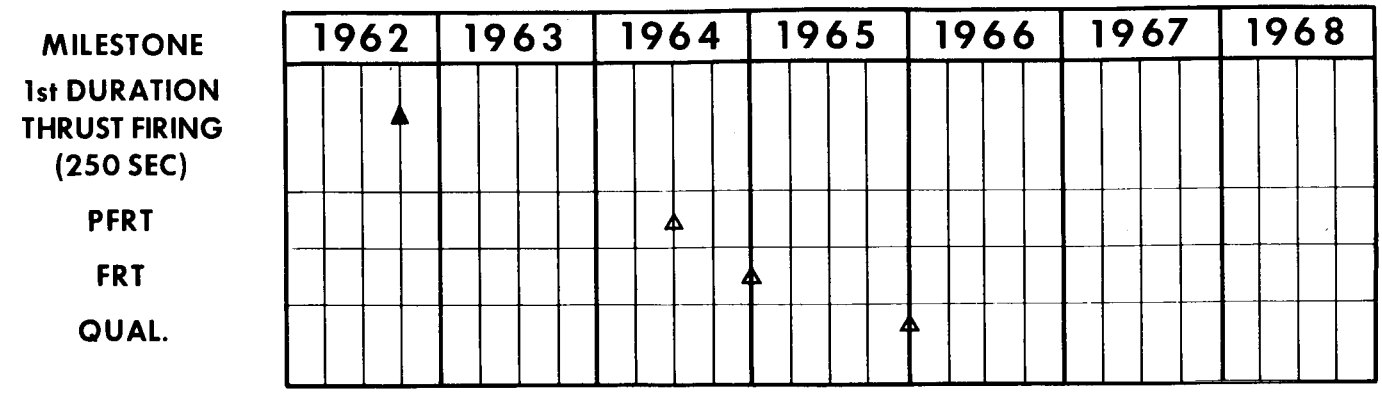
MAJOR FACILITY CONSTRUCTION

FACILITY	LOCATION	SUPPORTING REQS
ACCEPT TEST BETA 1	SACRAMENTO	STAND MODIFICATION
		GSE

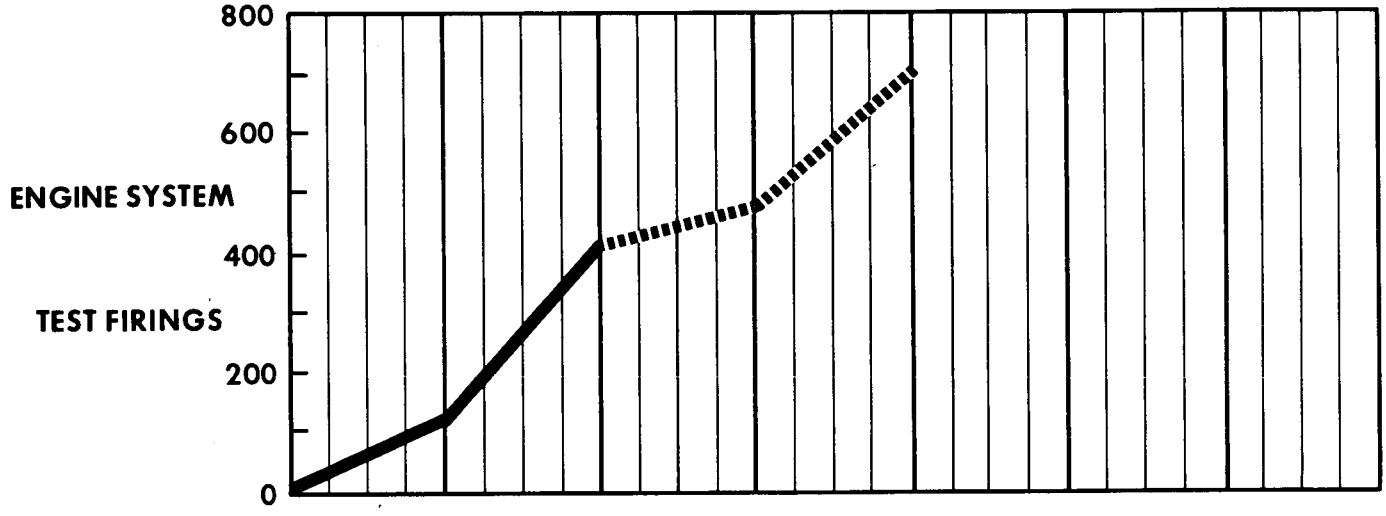


[redacted]

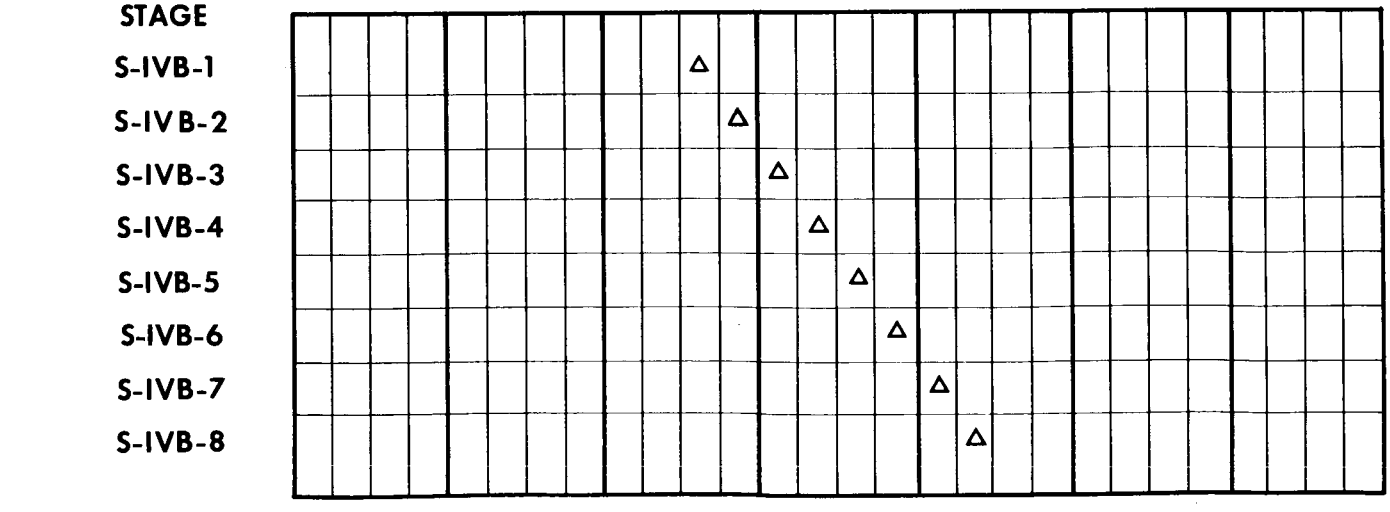
J-2 ENGINE DEVELOPMENT PLAN



ENGINE SYSTEM TESTS



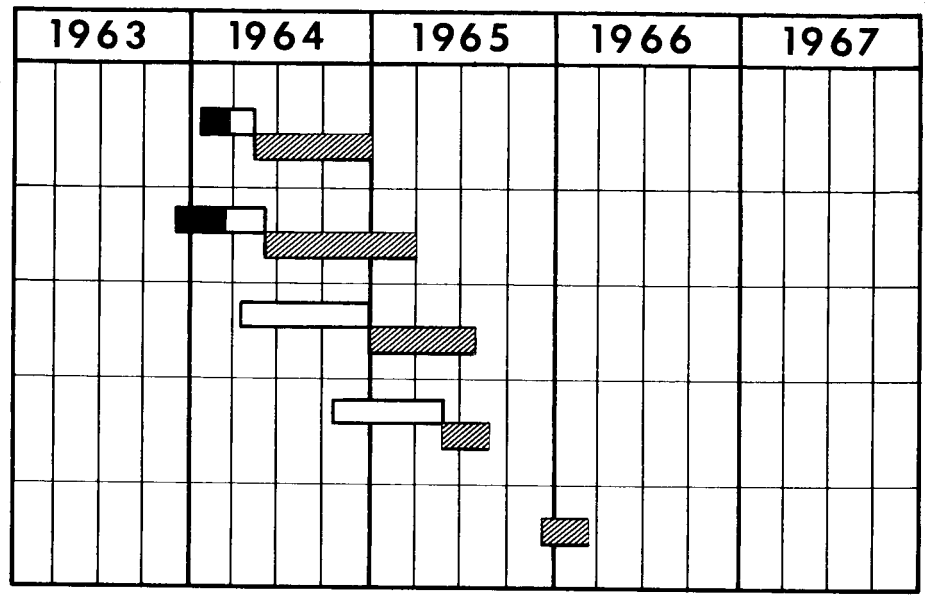
FLIGHT DELIVERY SCHEDULE



INSTRUMENT UNIT

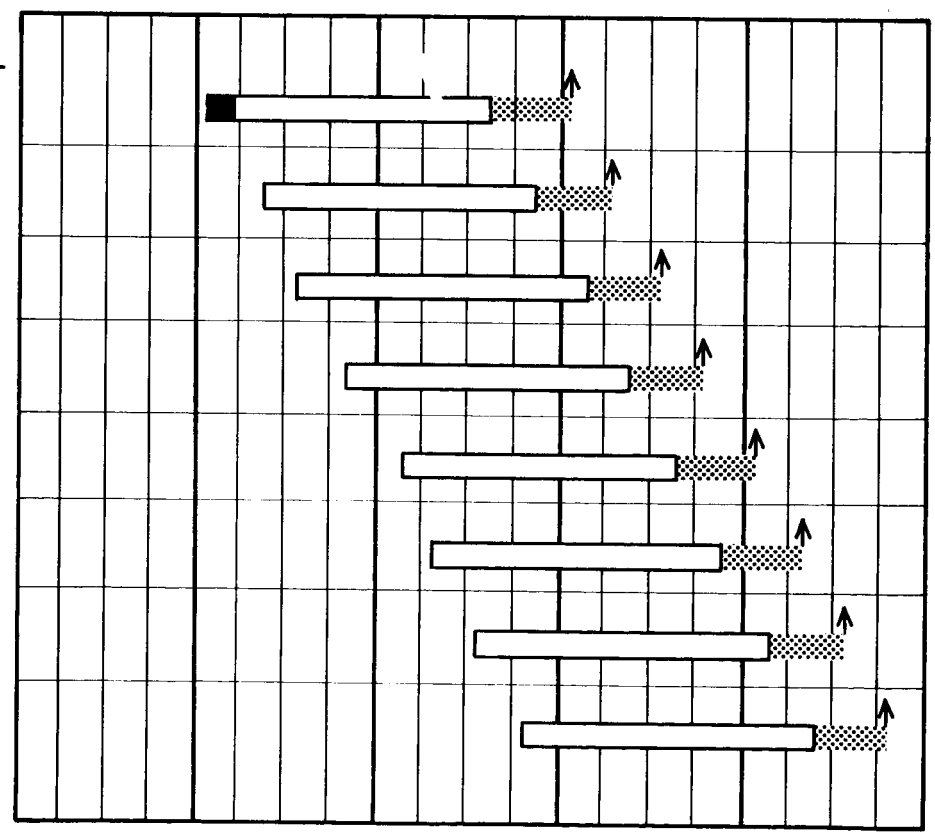
GROUND TEST PROGRAM

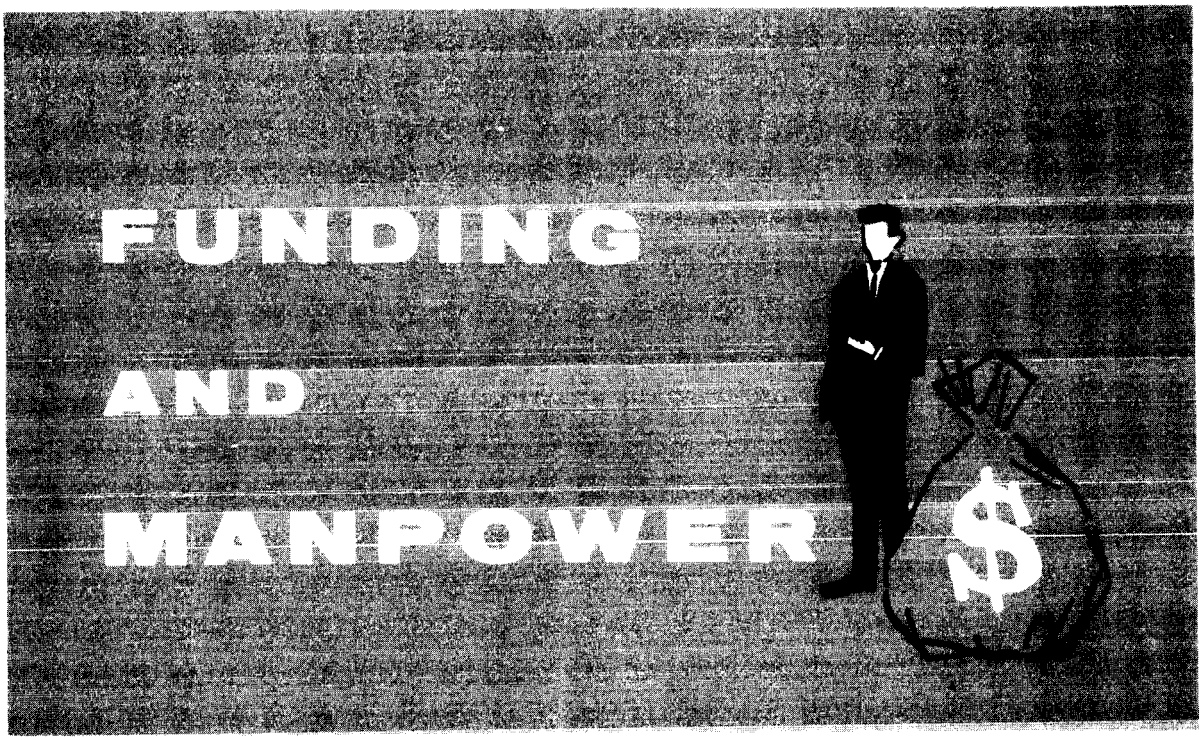
TYPE OF TEST	LOCATION
STRUCTURAL	MSFC
VIBRATION	MSFC
DYNAMIC	MSFC
FACILITIES C/O	L/C 34
FACILITIES C/O	L/C 37B



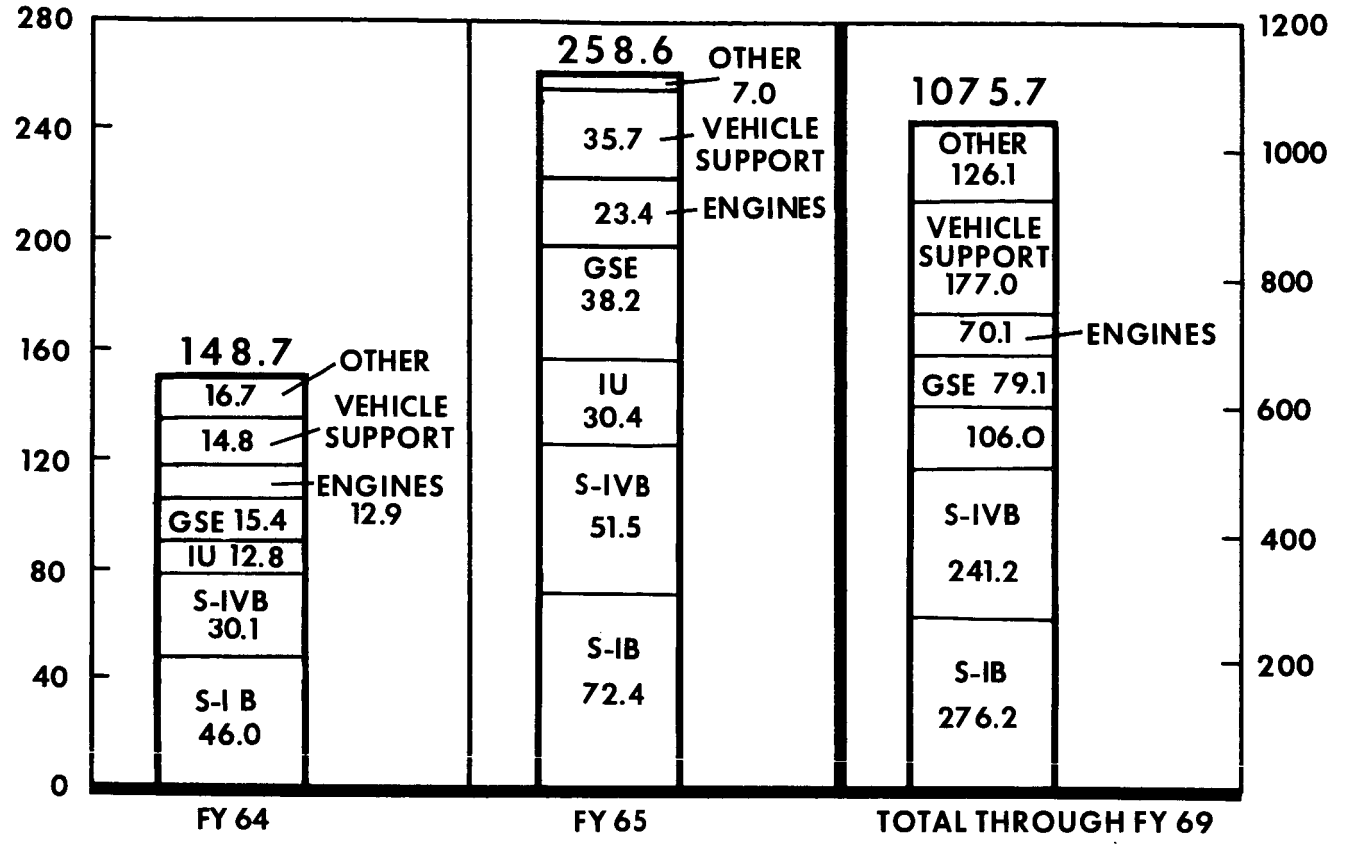
FABRICATION & DELIVERY FOR FLIGHT TEST

UNIT	FLIGHT
S-IU-201	201
S-IU-202	202
S-IU-203	203
S-IU-204	204
S-IU-205	205
S-IU-206	206
S-IU-207	207
S-IU-208	208

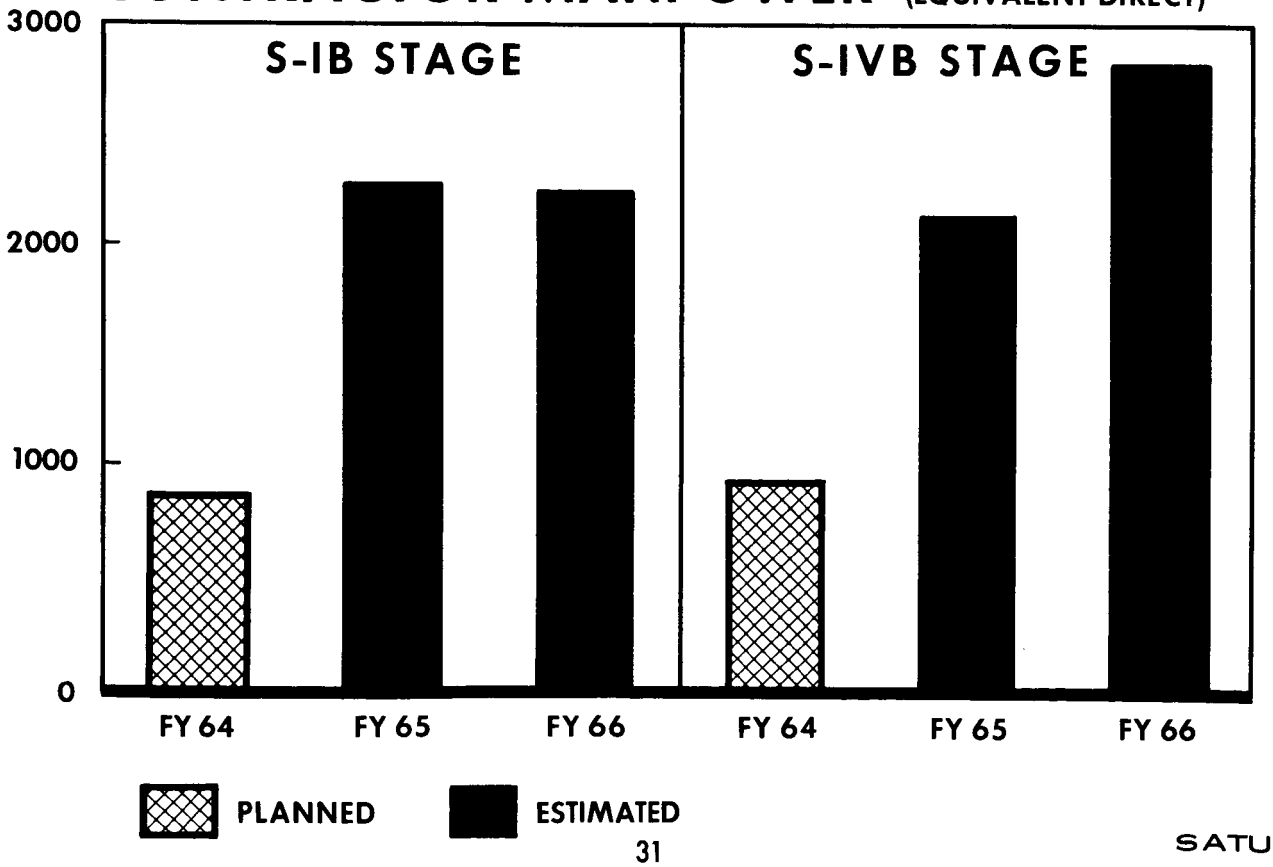



FUNDING
AND
MANPOWER
$

FUNDING (MILLIONS)



CONTRACTOR MANPOWER (EQUIVALENT DIRECT)



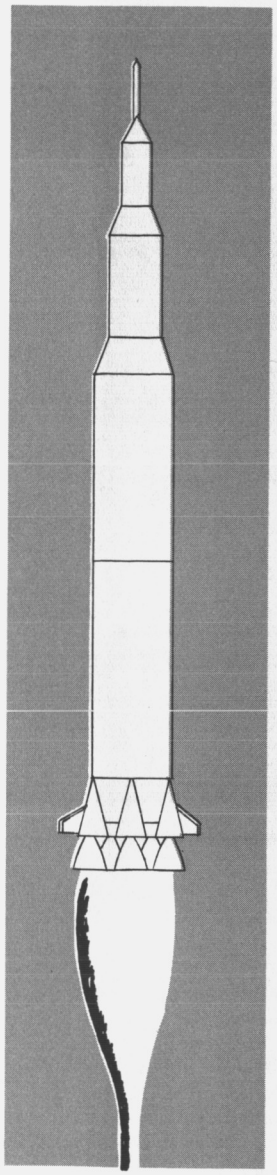
ACCOMPLISHMENTS

1963

- INITIATE FABRICATION OF ALL MAJOR GROUND TEST STAGES
- COMPLETE OVER 75% OF VEHICLE DESIGN AND ENGINEERING
- COMPLETED 500 SECOND J-2 ENGINE DURATION TEST
- COMPLETED 401 J-2 ENGINE FIRINGS FOR 14,270 SECONDS DURATION

1964

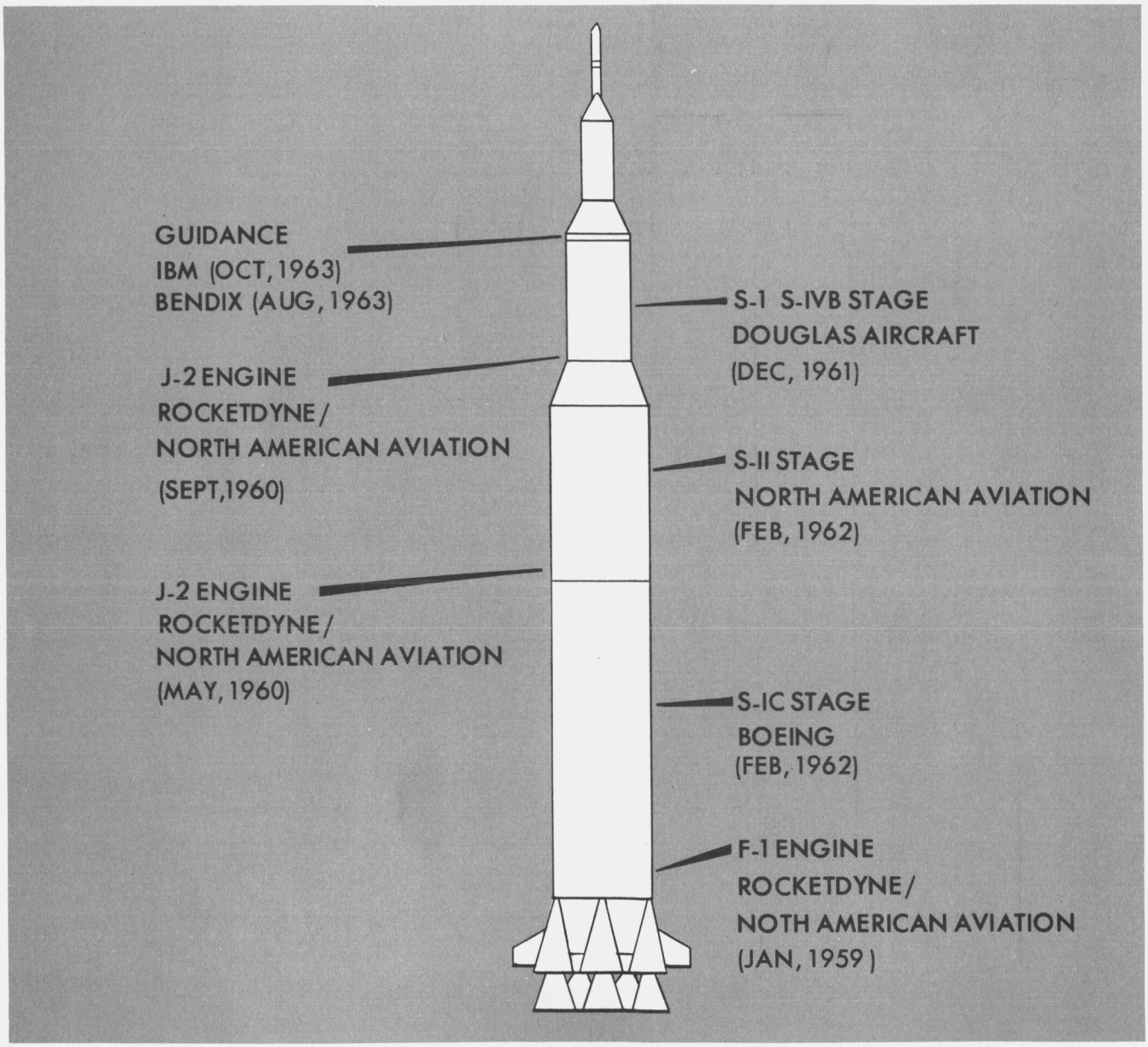
- COMPLETE VEHICLE DESIGN AND ENGINEERING
- COMPLETE 50% OF GROUND TEST PROGRAM
  - A STRUCTURAL TESTS COMPLETED ON BOTH STAGES
  - B BATTLESHIP TEST COMPLETED ON S-IV B STAGE
- FABRICATION OF ALL GROUND TEST STAGES NEARING COMPLETION
- COMPLETE FABRICATION OF SATURN 201 FLIGHT TEST S-IB STAGE
- FABRICATION OF SATURN 201 FLIGHT TEST S-IVB STAGE 75% COMPLETE
- COMPLETE COMPONENT QUALIFICATION OF 200K H-1 ENGINE
- COMPLETE PFRT ON J-2 ENGINE
- DELIVER J-2 ENGINES FOR FLIGHTS 201 AND 202



SATURN V

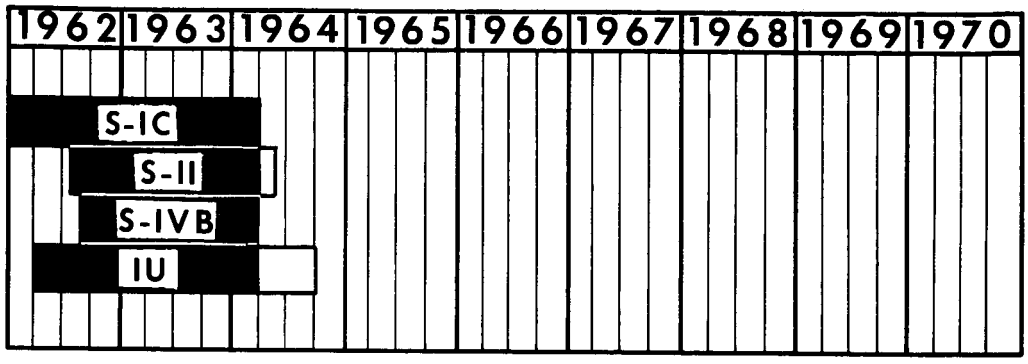
DEVELOPMENT PROGRAM

SATURN V
VEHICLE DEVELOPMENT TEAM

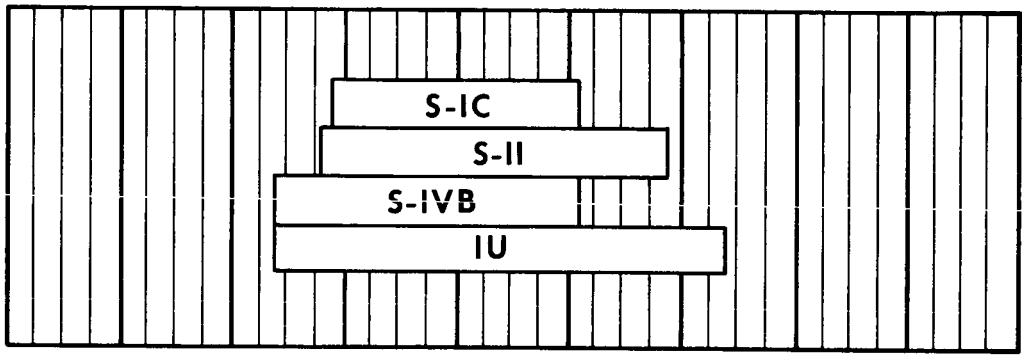


SATURN V PROGRAM PLAN

DESIGN & ENGINEERING

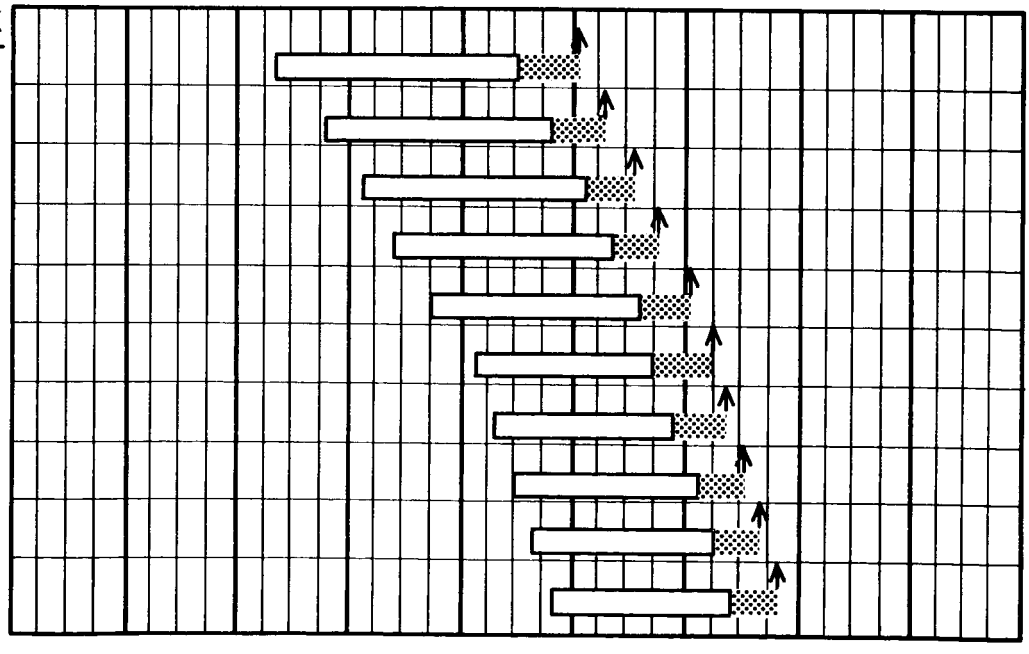


GROUND DEVELOPMENT TEST



FLIGHT TEST

FLIGHT	LAUNCH COMPLEX
501	37B
502	37B
503	37B
504	37B
505	37B
506	37B
507	37B
508	37B
509	37B
510	37B

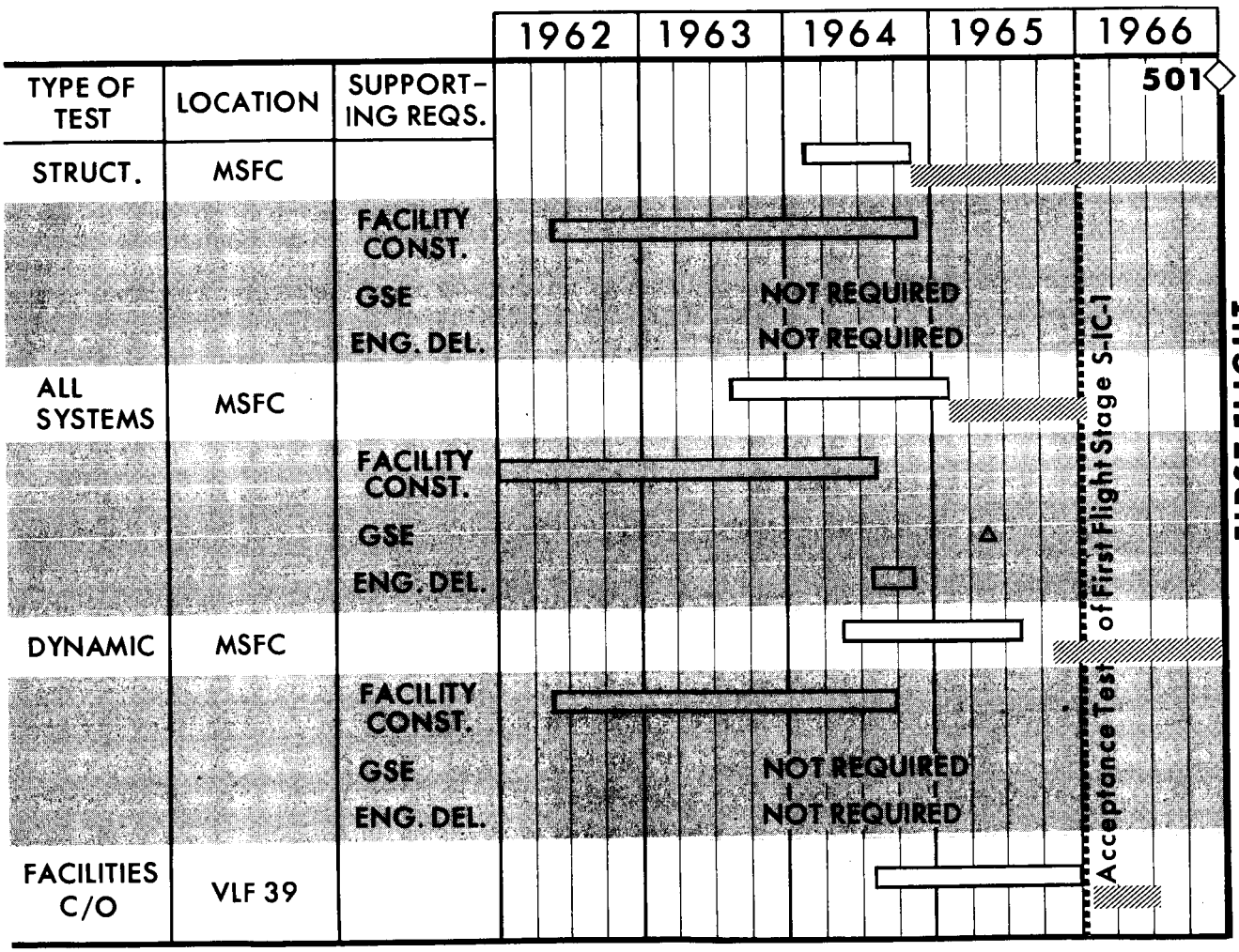


Fab, Assembly, C/O Del. KSC Operations Launch

[redacted]

S-IC STAGE

GROUND TEST PROGRAM

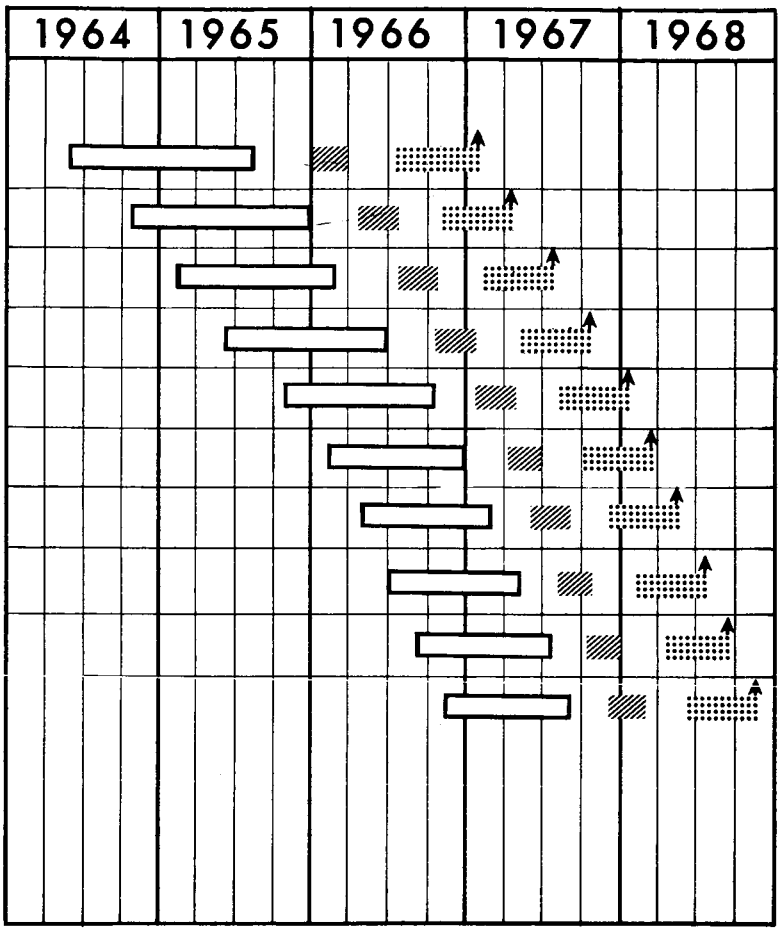


Fab, Assembly, C/O Test

[redacted]

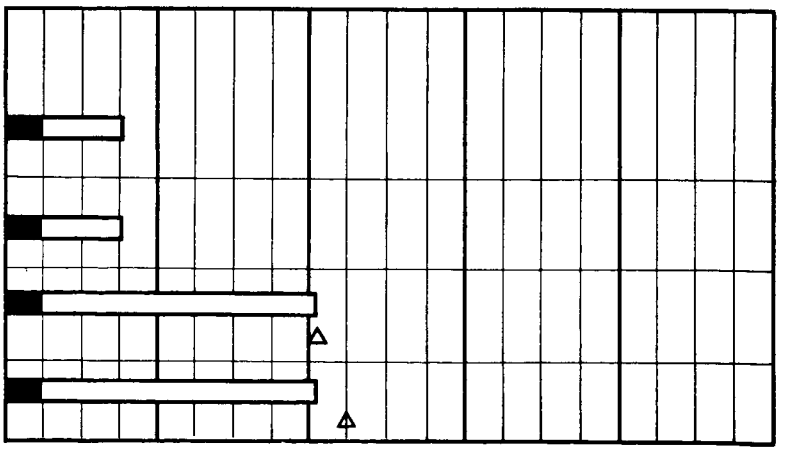
FABRICATION AND DELIVERY FOR FLIGHT TEST

STAGE	FLIGHT
S-IC-1	501
S-IC-2	502
S-IC-3	503
S-IC-4	504
S-IC-5	505
S-IC-6	506
S-IC-7	507
S-IC-8	508
S-IC-9	509
S-IC-10	510



MAJOR FACILITY CONSTRUCTION

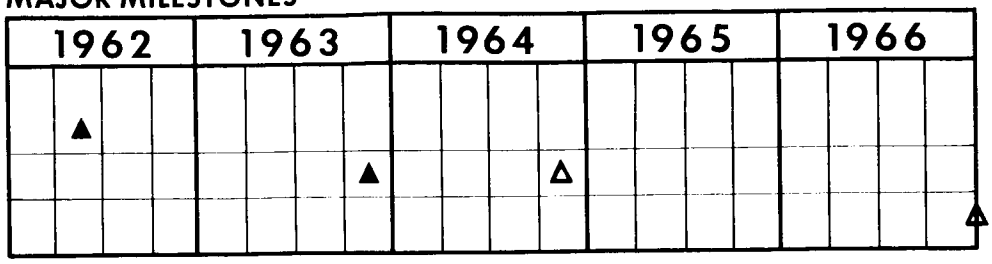
FACILITY	LOCATION	SUPPORTING REQS.
HYDROSTATIC TEST & CLEANING	MICHOUD	CONST.
VERTICAL ASSEMBLY	MICHOUD	CONST.
STATIC TEST (POSITION 1)	MTF	GSE
STATIC TEST (POSITION 2)	MTF	GSE



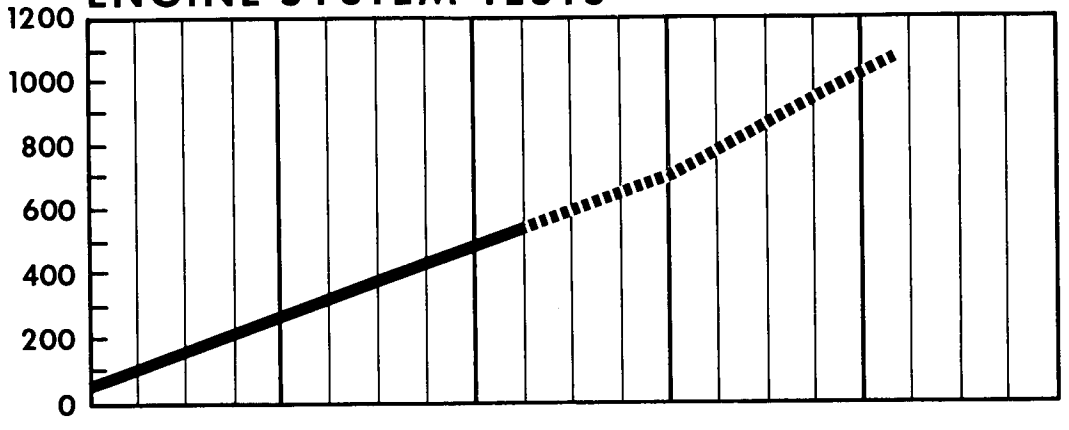
[redacted]

F-1 ENGINE DEVELOPMENT PLAN

MAJOR MILESTONES

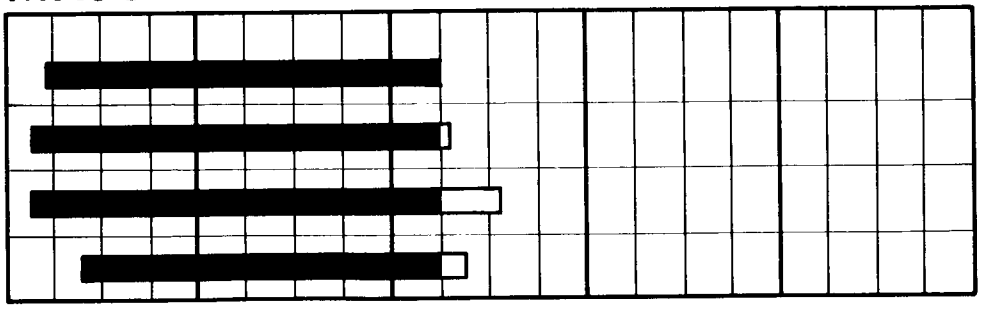


ENGINE SYSTEM TESTS



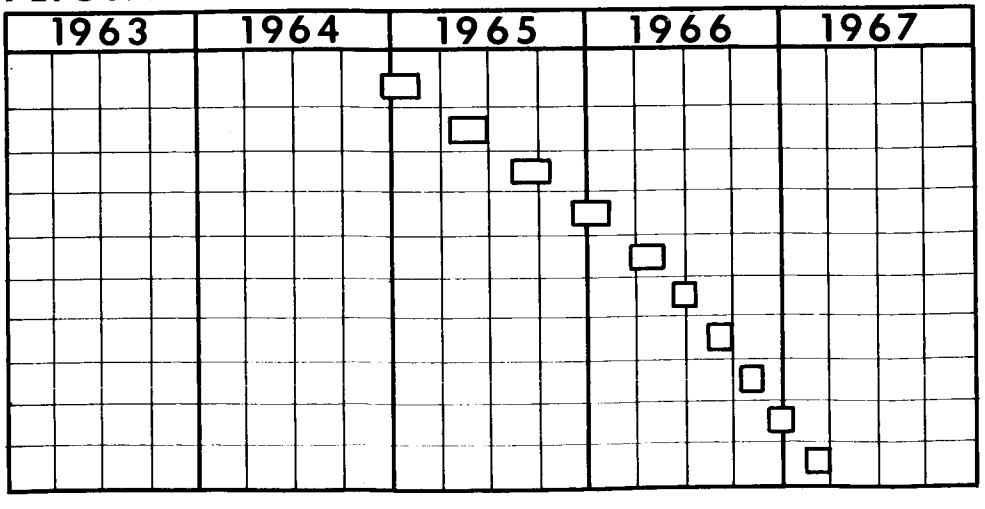
MAJOR FACILITY CONSTRUCTION

TEST STAND	LOCATION	TEST
ID	EDWARDS	ACCEPT
IC	EDWARDS	ACCEPT
IE	EDWARDS	ACCEPT
-	MSFC	DEV.



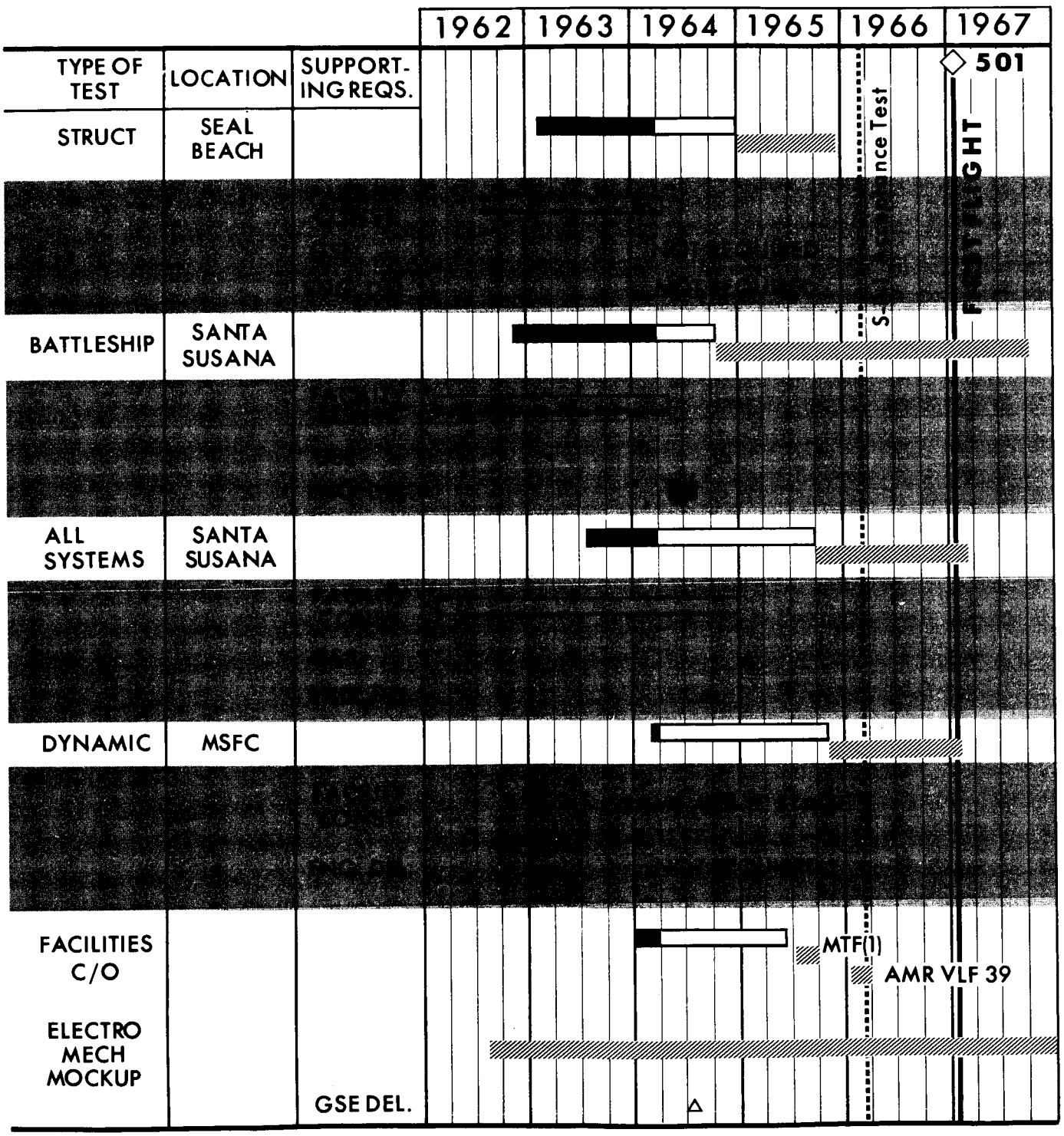
FLIGHT DELIVERY SCHEDULE

STAGE	FLIGHT
S-IC-1	501
S-IC-2	502
S-IC-3	503
S-IC-4	504
S-IC-5	505
S-IC-6	506
S-IC-7	507
S-IC-8	508
S-IC-9	509
S-IC-10	510



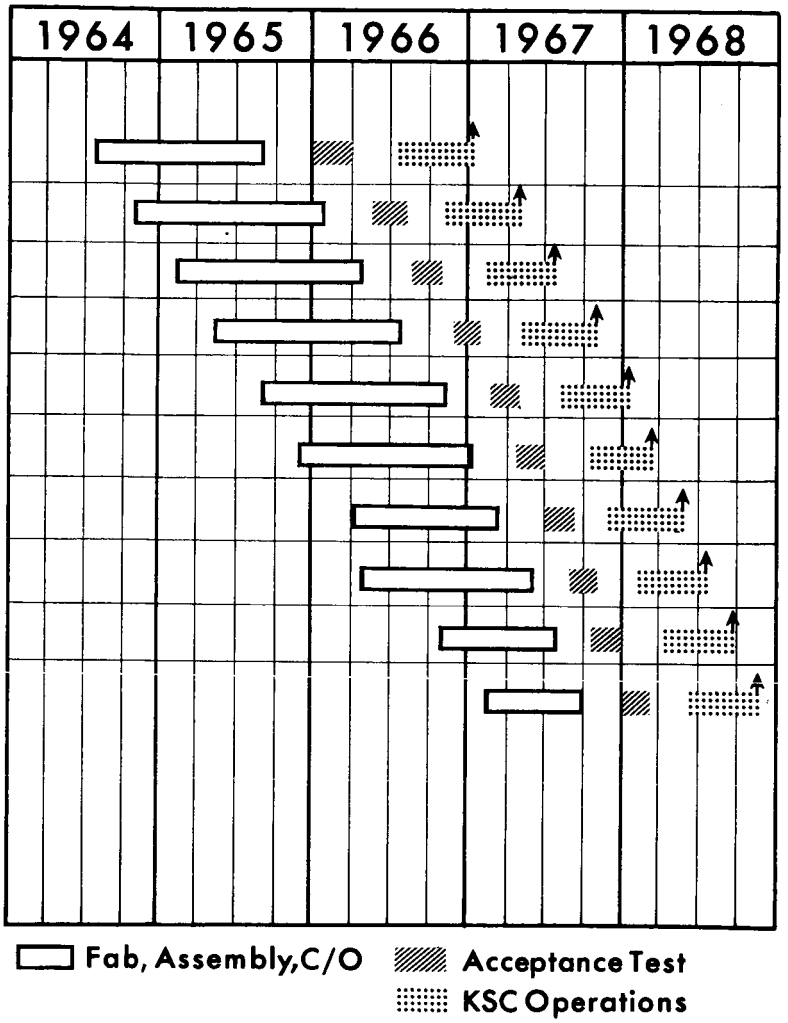
S-II STAGE

GROUND TEST PROGRAM



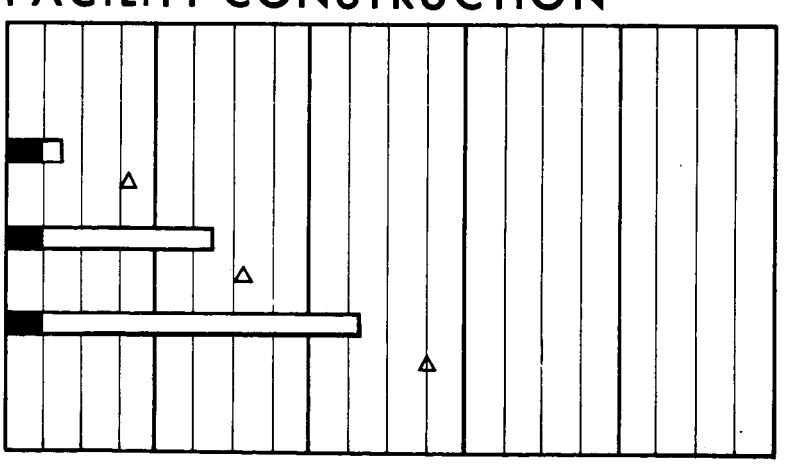
FABRICATION AND DELIVERY FOR FLIGHT TEST

STAGE	FLIGHT
S-II-1	501
S-II-2	502
S-II-3	503
S-II-4	504
S-II-5	505
S-II-6	506
S-II-7	507
S-II-8	508
S-II-9	509
S-II-10	510

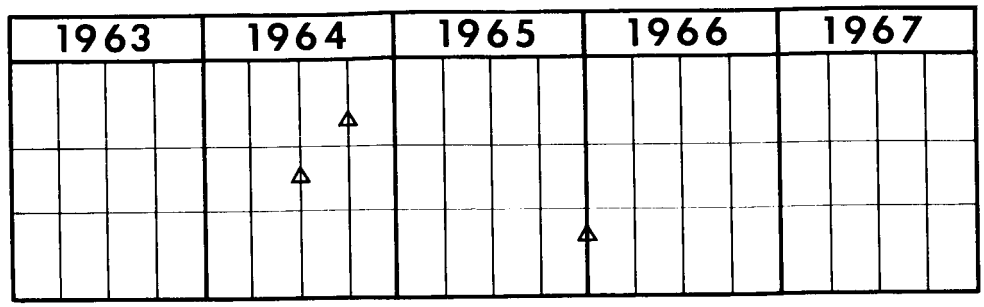


MAJOR FACILITY CONSTRUCTION

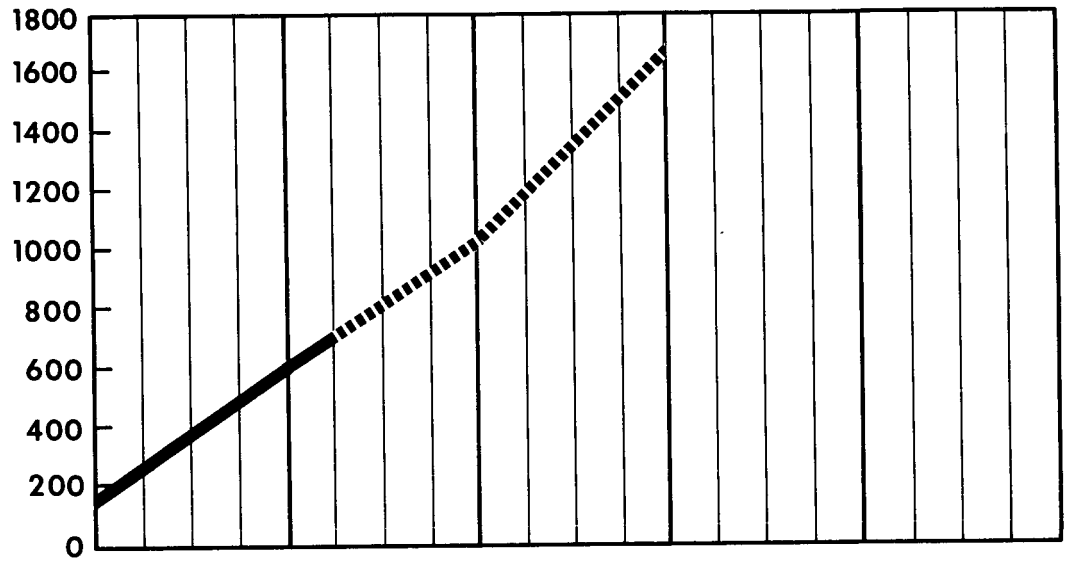
FACILITY	LOCATION	SUPPORTING REQS.
VAB AND HYDROSTATIC TEST	SEAL BEACH	CONST. GSE
STATIC TEST STAND #1	MTF	CONST. GSE
STATIC TEST STAND #2	MTF	CONST. GSE



J-2 ENGINE DEVELOPMENT PROGRAM

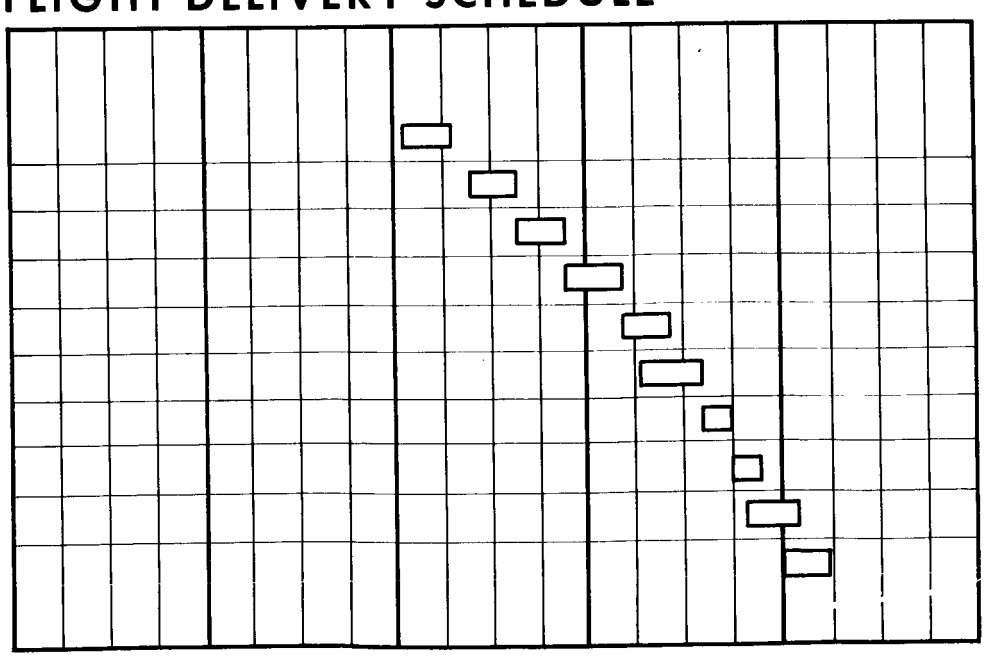


ENGINE SYSTEM TESTS



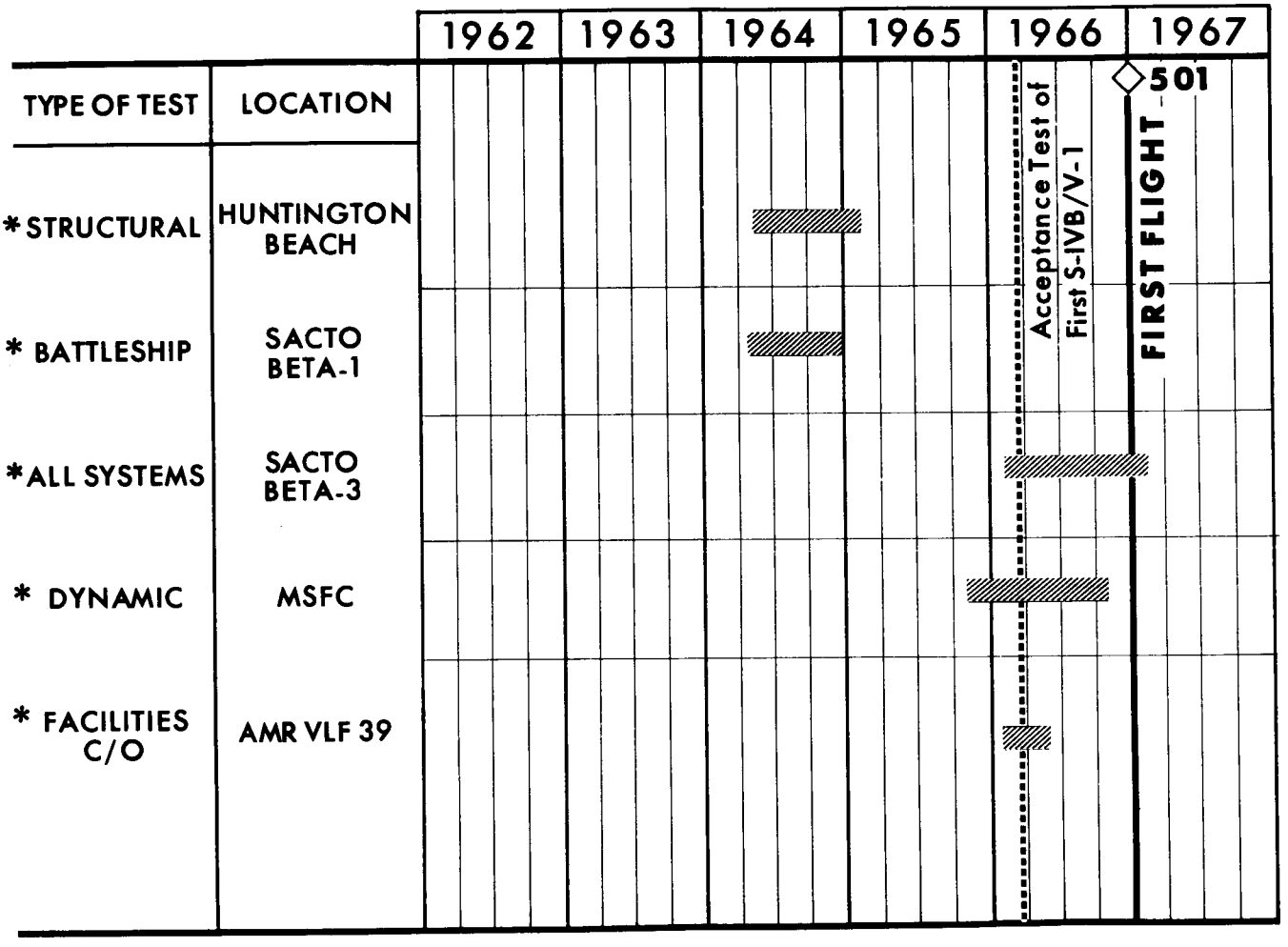
FLIGHT DELIVERY SCHEDULE

STAGE	FLIGHT
S-II-1	501
S-II-2	502
S-II-3	503
S-II-4	504
S-II-5	505
S-II-6	506
S-II-7	507
S-II-8	508
S-II-9	509
S-II-10	510



S-IVB/V STAGE

GROUND TEST PROGRAM

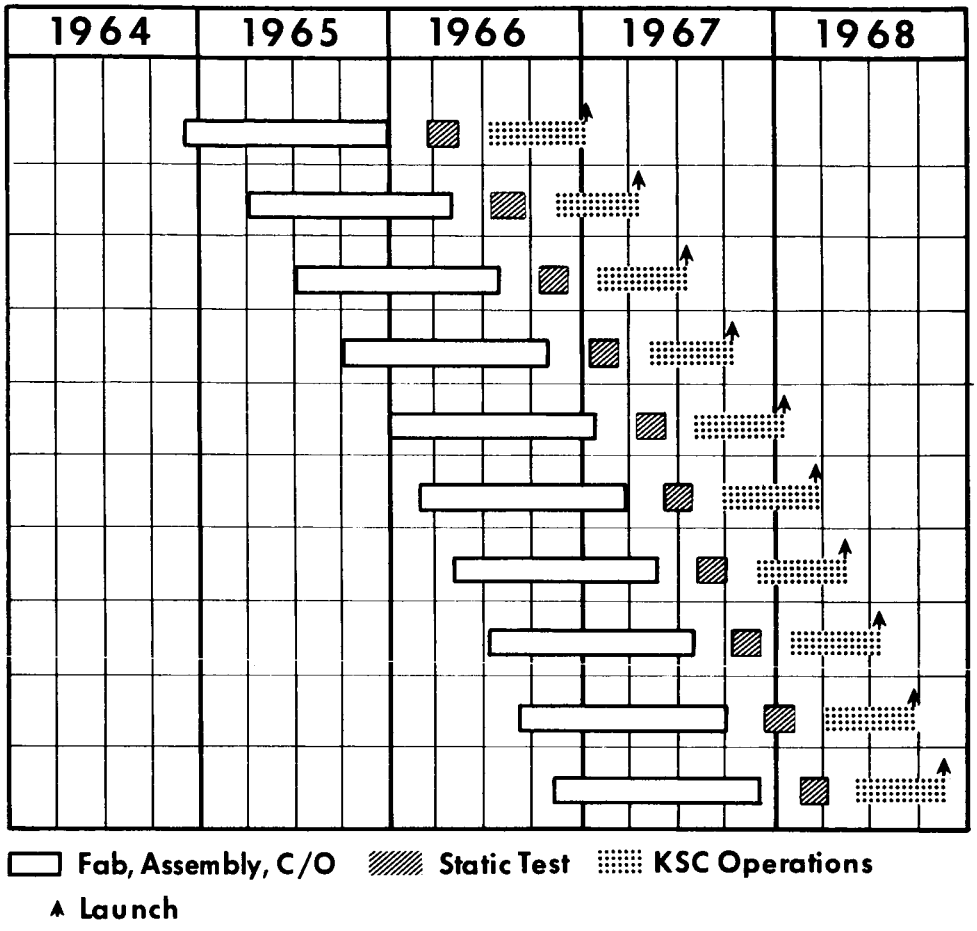


▨ Test

* Modified S-IVB/IB Ground Test Stages

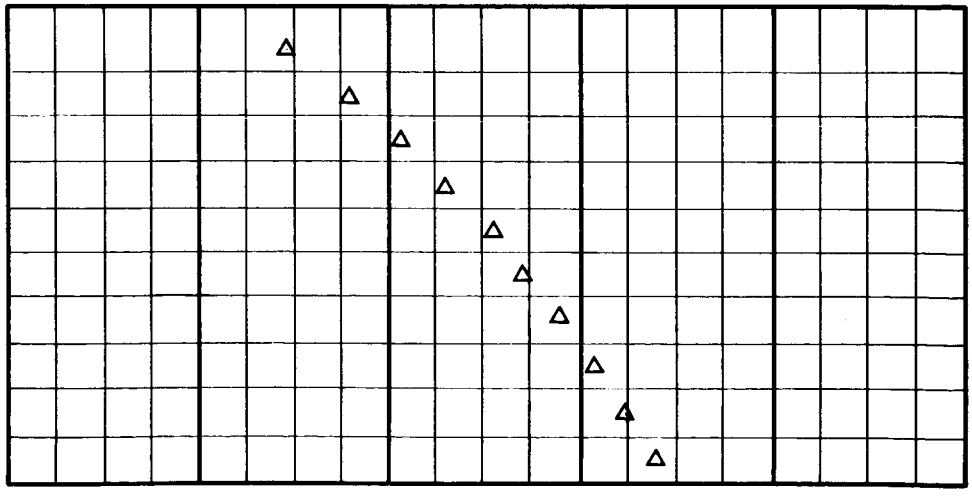
FABRICATION & DELIVERY FOR FLIGHT TEST

FLIGHT	STAGE
501	S-IVB-1
502	S-IVB-2
503	S-IVB-3
504	S-IVB-4
505	S-IVB-5
506	S-IVB-6
507	S-IVB-7
508	S-IVB-8
509	S-IVB-9
510	S-IVB-10

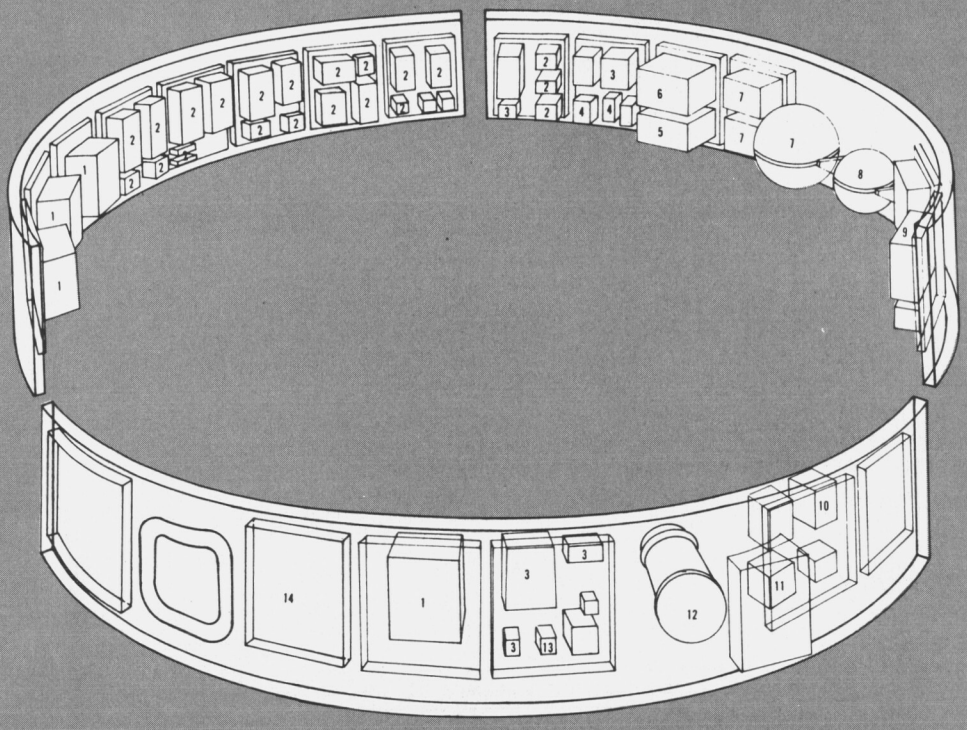


J-2 ENGINE DELIVERY SCHEDULE

FLIGHT	STAGE
501	S-IVB-1
502	S-IVB-2
503	S-IVB-3
504	S-IVB-4
505	S-IVB-5
506	S-IVB-6
507	S-IVB-7
508	S-IVB-8
509	S-IVB-9
510	S-IVB-10

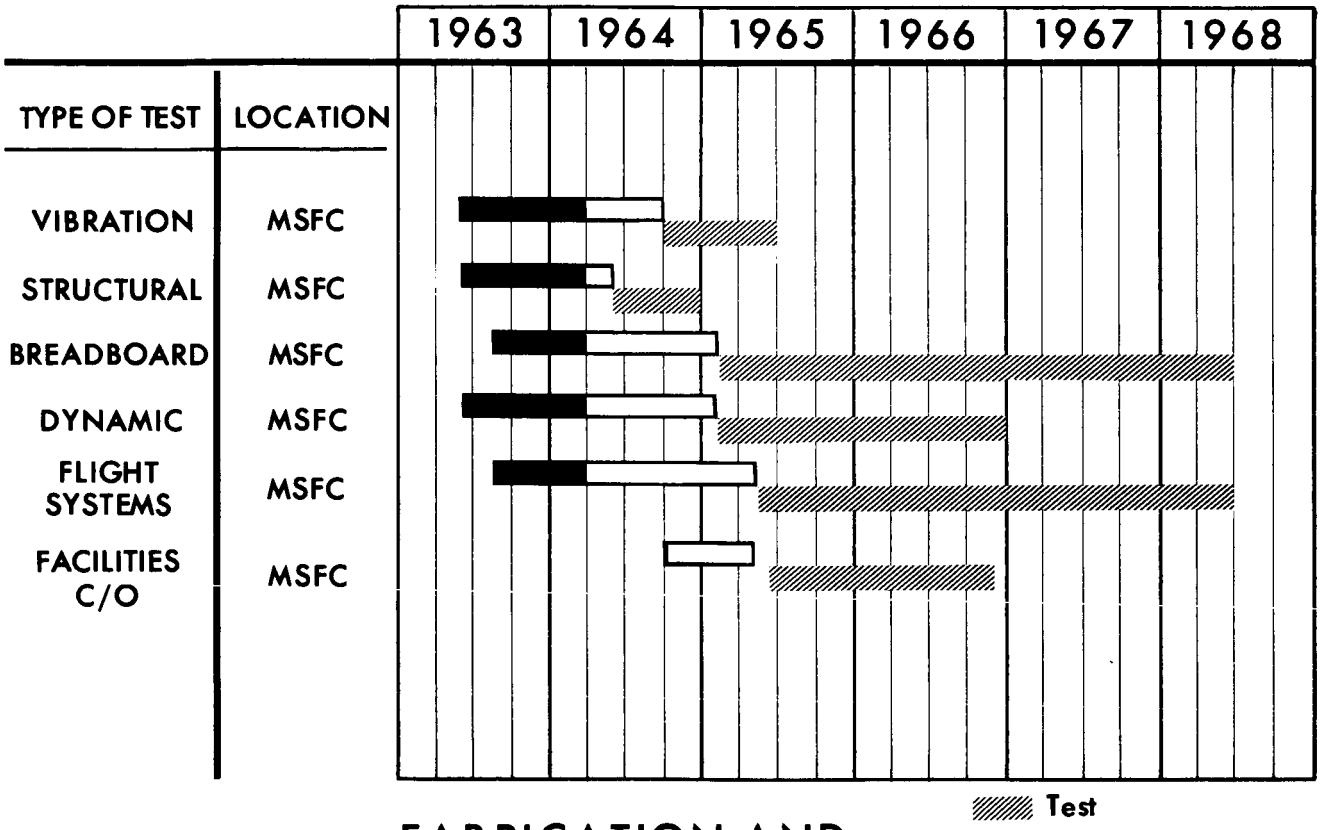


INSTRUMENT UNIT

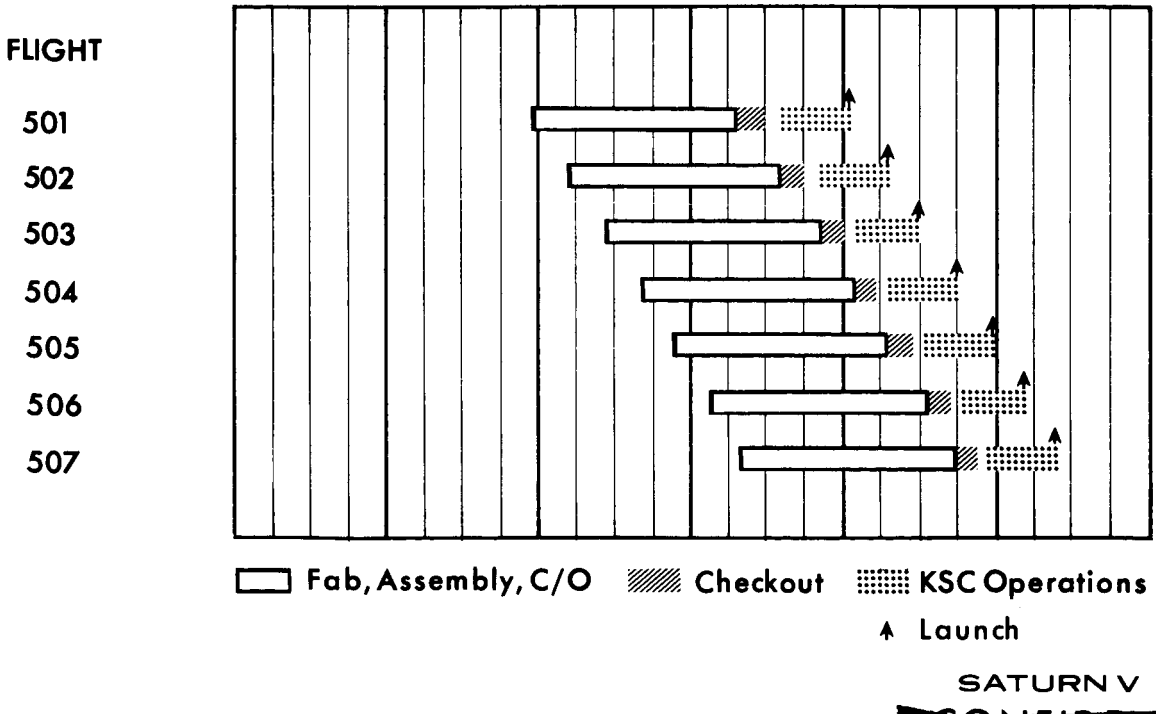


1. BATTERIES
2. TELEMETRY EQUIPMENT
3. ELECTRICAL POWER EQUIPMENT
4. SWITCH SELECTOR
5. DATA ADAPTOR
6. DIGITAL GUIDANCE COMPUTER
7. ST-124-M STABILIZED PLATFORM SYSTEM
8. PLATFORM AIR BEARING SUPPLY
9. FLIGHT CONTROL COMPUTER
10. RADAR ALTIMETER
11. AZUSA
12. HORIZON SENSOR
13. C-BAND RADAR
14. ENVIRONMENTAL CONTROL SYSTEM

GROUND TEST PROGRAM

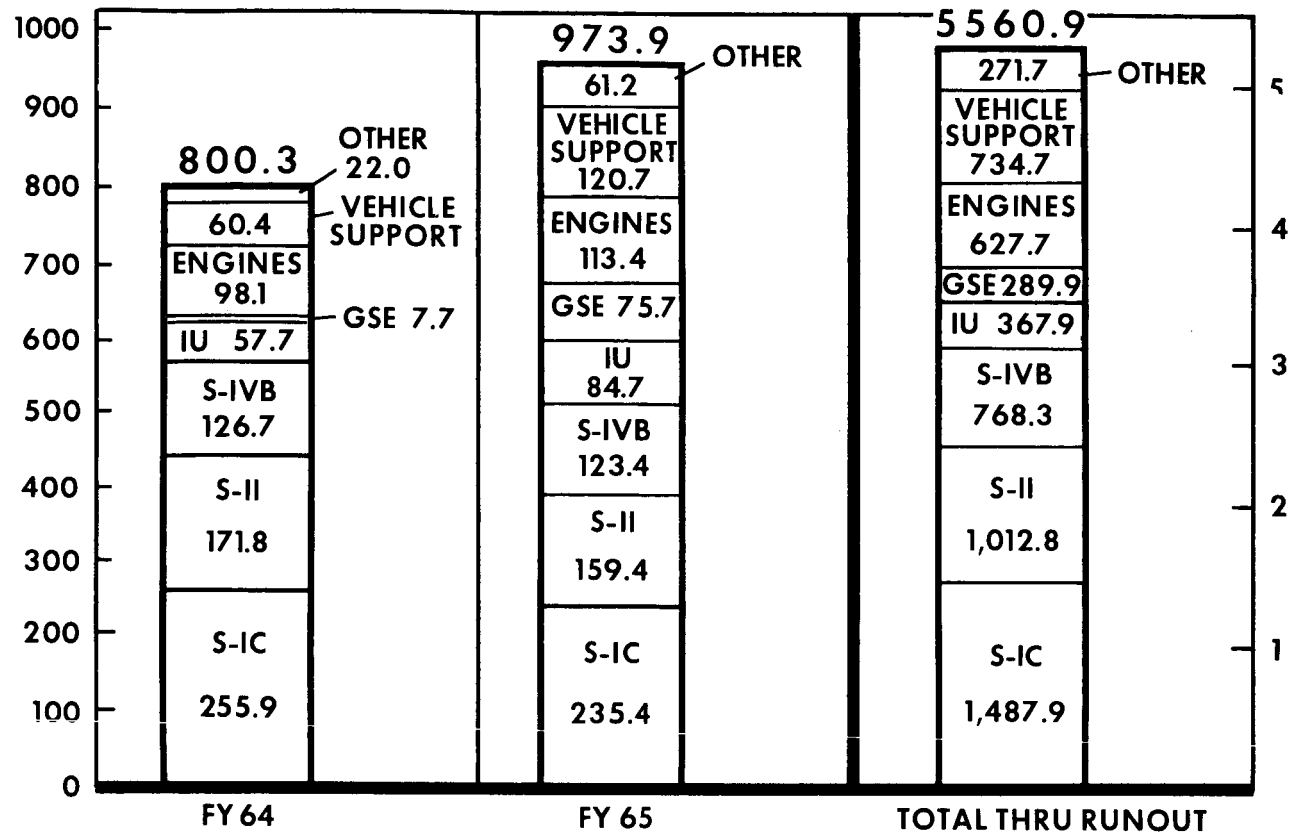


FABRICATION AND DELIVERY FOR FLIGHT TESTS

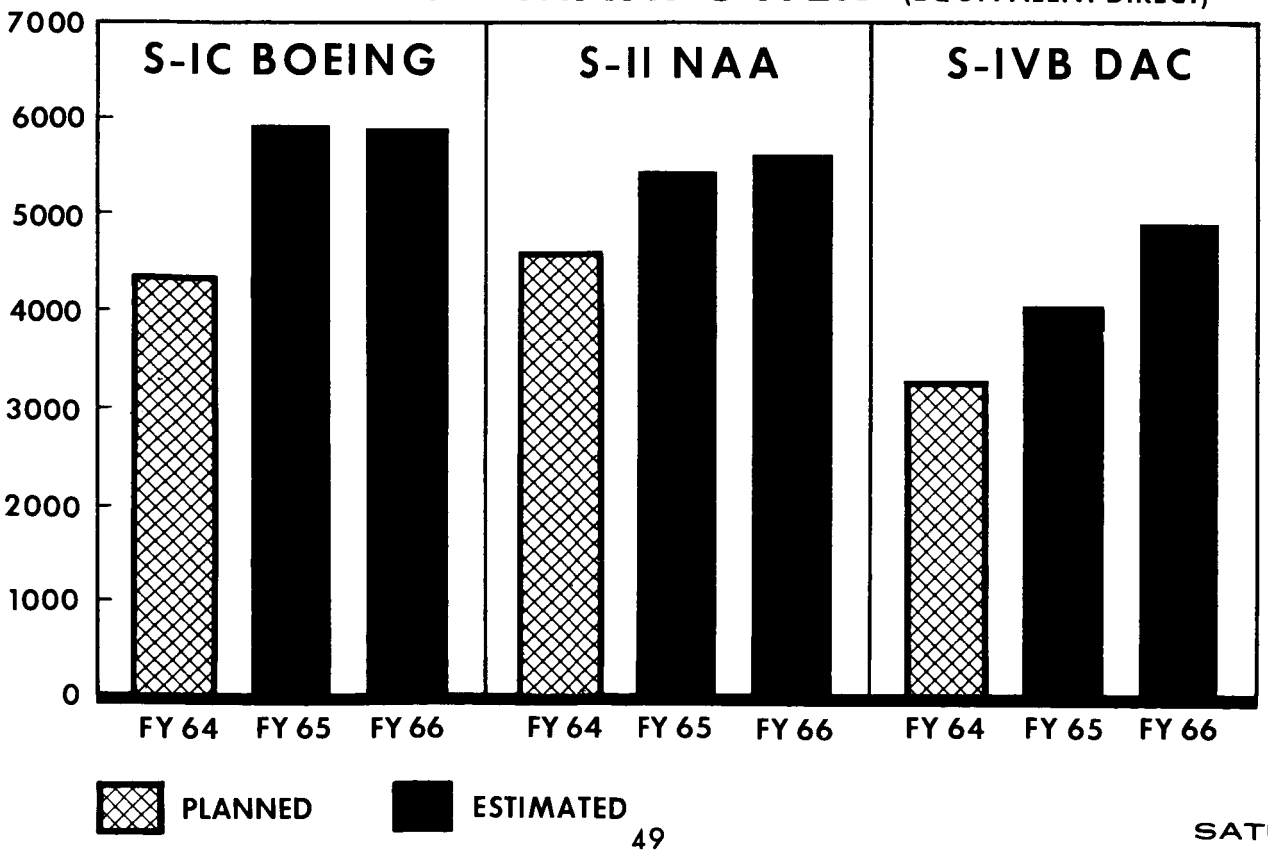


FUNDING
AND
MANPOWER

FUNDING (MILLIONS)



CONTRACTOR MANPOWER (EQUIVALENT DIRECT)



ACCOMPLISHMENTS

1963

- COMPLETE OVER 75% OF VEHICLE DESIGN & ENGINEERING
- INITIATE FABRICATION OF GROUND TEST STAGES
- COMPLETED S-IC FUEL TANK
- COMPLETION OF S-IC Y RING FIRST MAJOR COMPONENT MANUFACTURED AT MICHOUD
- FIRST F-1 ENGINE DELIVERED
- INITIATED FIRST F-1 ENGINE TESTS AT MSFC
- COMPLETED OVER 80% OF CONSTRUCTION OF F-1 ENGINE TEST STANDS AT EDWARDS
- CONSTRUCTION OF DYNAMIC TEST TOWER
- CONSTRUCTION OF S-II STAGE TEST STAND BEGUN
- SEAL BEACH FACILITY OPERATIONAL
- COMPLETED OVER 200 F-1 ENGINE SYSTEM FIRINGS
- COMPLETED 600 J-2 ENGINE FIRINGS

1964

- COMPLETE VEHICLE DESIGN & ENGINEERING
- INITIATE MAJOR GROUND TESTS ON ALL STAGES
- COMPLETE F-1 ENGINE PFRT
- INITIATE FABRICATION OF STAGES FOR FLIGHT 501